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For related information see also *34 Fluid Mechanics and Heat Transfer*

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Includes cockpit and cabin display devices; and flight instruments.

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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For related information see also *Aeronautics*

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20 SPACECRAFT PROPULSION AND POWER 2998

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Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE **3106**
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION **3106**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) **3107**

89 ASTRONOMY **3117**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS **3118**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION **3121**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **3122**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **3122**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL **N.A.**

Note: N.A. means that no abstracts were assigned to this category for this issue.

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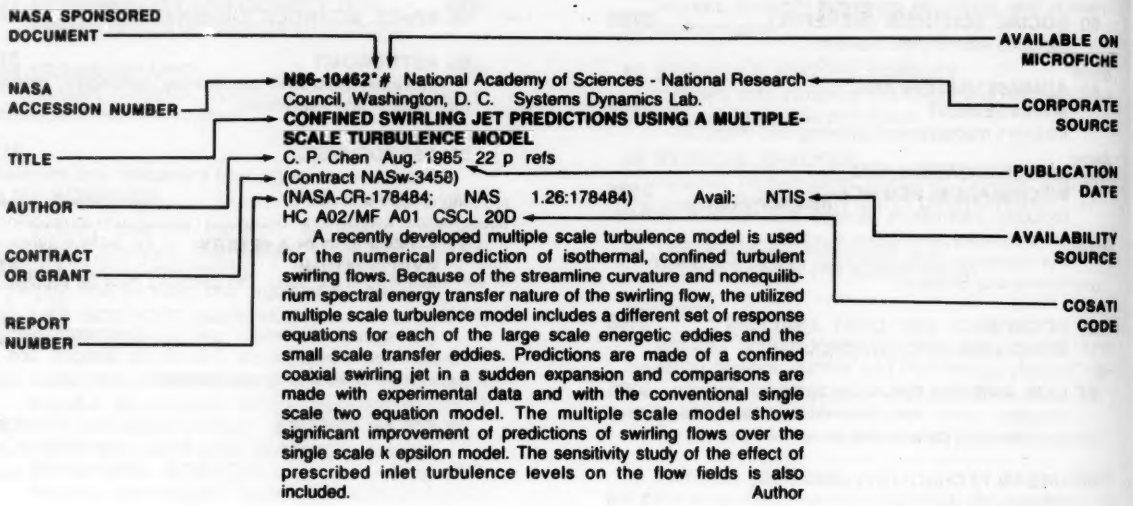
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

VOLUME 24 NUMBER 19 / OCTOBER 8, 1986

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-28048* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 201)
Jun. 1986 126 p
(NASA-SP-7037(201); NAS 1.21:7037(201)) Avail: NTIS HC A06 CSCL 01A

This bibliography lists 438 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1986. Author

N86-28049*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A TIME-BASED CONCEPT FOR TERMINAL-AREA TRAFFIC MANAGEMENT
Heinz Erzberger and Leonard Tobias Apr. 1986 17 p Presented at the 42nd AGARD Guidance and Control Panel Symposium, Brussels, Belgium, 6-9 May, 1985
(NASA-TM-88243; NAS 1.15:88243) Avail: NTIS HC A02/MF A01 CSCL 01B

An automated air-traffic-management concept that has the potential for significantly increasing the efficiency of traffic flows in high-density terminal areas is discussed. The concept's implementation depends on the techniques for controlling the landing time of all aircraft entering the terminal area, both those that are equipped with on-board four dimensional guidance systems as well as those aircraft types that are conventionally equipped. The two major ground-based elements of the system are a scheduler which assigns conflict-free landing times and a profile descent advisor. Landing times provided by the scheduler are uplinked to equipped aircraft and translated into the appropriate four dimensional trajectory by the on-board flight-management system. The controller issues descent advisories to unequipped aircraft to help them achieve the assigned landing times. Air traffic control simulations have established that the concept provides an efficient method for controlling various mixes of four dimensional-equipped and unequipped, as well as low-and high-performance, aircraft. Author

N86-28050*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GEOMETRY DEFINITION AND GRID GENERATION FOR A COMPLETE FIGHTER AIRCRAFT
Thomas A. Edwards Apr. 1986 15 p Presented at the AGARD Symposium on Applications of CED in Aeronautics, Aix en Provence, France, 7-10 Apr. 1986
(NASA-TM-88242; A-86208; NAS 1.15:88242) Avail: NTIS HC A02/MF A01 CSCL 01B

Recent advances in computing power and numerical solution procedures have enabled computational fluid dynamicists to attempt increasingly difficult problems. In particular, efforts are focusing on computations of complex three-dimensional flow fields about realistic aerodynamic bodies. To perform such computations, a very accurate and detailed description of the surface geometry must be provided, and a three-dimensional grid must be generated in the space around the body. The geometry must be supplied in a format compatible with the grid generation requirements, and must be verified to be free of inconsistencies. This paper presents a procedure for performing the geometry definition of a fighter aircraft that makes use of a commercial computer-aided design/computer-aided manufacturing system. Furthermore, visual representations of the geometry are generated using a computer graphics system for verification of the body definition. Finally, the three-dimensional grids for fighter-like aircraft are generated by means of an efficient new parabolic grid generation method. This method exhibits good control of grid quality. Author

N86-28051*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT AND VALIDATION OF THE CREW-STATION SYSTEM-INTEGRATION RESEARCH FACILITY
Bill Nedell, Gordon Hardy, Ted Lichtenstein, Gary Leong, and David Thompson May 1986 24 p
(NASA-TM-86841; A-85410; NAS 1.15:86841) Avail: NTIS HC A02/MF A01 CSCL 01B

The various issues associated with the use of integrated flight management systems in aircraft were discussed. To address these issues a fixed base integrated flight research (IFR) simulation of a helicopter was developed to support experiments that contribute to the understanding of design criteria for rotorcraft cockpits incorporating advanced integrated flight management systems. A validation experiment was conducted that demonstrates the main features of the facility and the capability to conduct crew/system integration research. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-28052*# National Aeronautics and Space Administration, Washington, D.C.
FORMATION OF ASYMMETRIC SEPARATED FLOW PAST SLENDER BODIES OF REVOLUTION AT LARGE ANGLES OF ATTACK
M. G. Goman and A. N. Khrabrov Jun. 1986 17 p Transl. into ENGLISH from Uchenye Zapiski TsAGI (USSR), vol. 15, no. 6, 1984 p 1-9 Previously announced as A86-13429 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NAS2-4005)
(NASA-TM-88441; NAS 1.15:88441; ISSN-0321-3249) Avail: NTIS HC A02/MF A01 CSCL 01A

The paper examines the problem of determining stationary positions of pairs of vortices of unequal intensity in the flow behind a cylinder modeling the axisymmetric separated flow past a slender body at large angles of attack. The possible asymmetric stationary positions of two vortices are calculated, and their stability with respect to small perturbations is determined. Bifurcations of the flow field with changes in vortex intensity are analyzed. Author

N86-28053*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER FRINGE ANEMOMETRY FOR AERO ENGINE COMPONENTS
Anthony J. Strazisar 1986 54 p Presented at the 67th Symposium of the AGARD Propulsion and Energetics Panel on Advanced Instrumentation for Aero Engine Components, Philadelphia, Pa., 19-23 May 1986
(NASA-TM-88798; E-3135; NAS 1.15:88798) Avail: NTIS HC A02/MF A01 CSCL 01A

Advances in flow measurement techniques in turbomachinery continue to be paced by the need to obtain detailed data for use in validating numerical predictions of the flowfield and for use in the development of empirical models for those flow features which cannot be readily modelled numerically. The use of laser anemometry in turbomachinery research has grown over the last 14 years in response to these needs. Based on past applications and current developments, this paper reviews the key issues which are involved when considering the application of laser anemometry to the measurement of turbomachinery flowfields. Aspects of laser fringe anemometer optical design which are applicable to turbomachinery research are briefly reviewed. Application problems which are common to both laser fringe anemometry (LFA) and laser transit anemometry (LTA) such as seed particle injection, optical access to the flowfield, and measurement of rotor rotational position are covered. The efficiency of various data acquisition schemes is analyzed and issues related to data integrity and error estimation are addressed. Real-time data analysis techniques aimed at capturing flow physics in real time are discussed. Finally, data reduction and analysis techniques are discussed and illustrated using examples taken from several LFA turbomachinery applications. Author

N86-28054*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIAXIS AIRCRAFT CONTROL POWER FROM THRUST VECTORING AT HIGH ANGLES OF ATTACK
Francis J. Capone and Mary L. Mason Jun. 1986 51 p Presented at the AIAA 4th Applied Aerodynamics Conference, San Diego, Calif., 9-11 Jun. 1986
(NASA-TM-87741; NAS 1.15:87741; AIAA-86-1779) Avail: NTIS HC A03/MF A01 CSCL 01A

Extensive research programs conducted at the Langley Research Center have shown that thrust vectoring can be provided by multifunction (nonaxisymmetric) nozzles. Most of this research has been conducted on pitch vectoring at both static and forward flight conditions. Recent efforts have been aimed at evaluating yaw vectoring concepts at static (wind off) conditions. This paper summarizes results for three different twin-engine fighter configurations tested over a Mach number range of 0.15 to 2.47 at angles of attack up to 35 deg. The objective of these investigations was to determine the multiaxis control power characteristics provided by thrust vectoring. All three configurations employed two-dimensional convergent-divergent nozzles which provided pitch vectoring by differential deflection of the upper and lower nozzle divergent flaps. Three different means of yaw vectoring were tested: (1) a translating nozzle sidewall; (2) yaw flaps located in the nozzle sidewalls; and (3) canted nozzles. These investigations were conducted in the Langley 16-Foot Transonic Tunnel and the Lewis 10x10-Foot Supersonic Tunnel. Longitudinal and direction control power from thrust vectoring was greater than that provided by aerodynamic control effectors at low speed or at high angles of attack. Author

N86-28055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROTOR WAKE CHARACTERISTICS OF A TRANSONIC AXIAL FLOW FAN
M. D. Hathaway (Army Aviation Research and Technology Activity, Cleveland, Ohio), J. Gertz (Massachusetts Inst. of Tech., Cambridge), A. Epstein, and A. J. Strazisar 1985 13 p Presented at the 21st Joint Propulsion Conference, Monterey, Calif., 8-10 Jul. 1985; sponsored by AIAA, SAE, ASME and ASEE Previously announced in IAA as A85-43974
(NASA-TM-87073; E-2644; USAAVSCOM-TR-85-C-8; AIAA-85-1133; NAS 1.15:87073) Avail: NTIS HC A02/MF A01 CSCL 01A

State of the art turbomachinery flow analysis codes are not capable of predicting the viscous flow features within turbomachinery blade wakes. Until efficient 3D viscous flow analysis codes become a reality there is therefore a need for models which can describe the generation and transport of blade wakes and the mixing process within the wake. To address the need for experimental data to support the development of such models, high response pressure measurements and laser anemometer velocity measurements were obtained in the wake of a transonic axial flow fan rotor. Author

N86-28056*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HOVER IN-GROUND-EFFECT TESTING OF A FULL-SCALE, TILT-NACELLE V/STOL MODEL
James E. Eshleman, Michael R. Dudley, and Charles J. Schell (Grumman Aerospace Corp., Bethpage, N.Y.) Feb. 1986 18 p Presented at the 14th AIAA Aerodynamic Testing Conference, West Palm Beach, Fla., 5-7 Mar. 1986
(NASA-TM-88218; A-86127; NAS 1.15:88218) Avail: NTIS HC A02/MF A01 CSCL 01A

A full-scale, tilt-nacelle V/STOL aircraft model was tested in hover at the National Full Scale Aerodynamics Complex (NFAC), NASA Ames Research Center. The model was powered by two TF-34 turbofan engines. It was tested at several ground heights and control deflections. Test technique and test setup were documented. Limited results show that: (1) a small change in control power with ground height was measured, and control power was found to be good over + or - 20 deg of horizontal vane deflection; (2) integrated fuselage undersurface pressures, when compared with the total model loads and measured thrust, defined the effect of the fountain and its related flow field on model forces and moments; and (3) there was no indication of hot gas ingestion during simulated takeoff in calm winds from wheels on deck ground height. Author

N86-28057*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PERSPECTIVE OF COMPUTATIONAL FLUID DYNAMICS
Paul Kutler May 1986 22 p Presented at the National Aerospace Lab., Tokyo, Japan, 20 Jun. 1986
(NASA-TM-88246; A-86224; NAS 1.15:88246) Avail: NTIS HC A02/MF A01 CSCL 01A

Computational fluid dynamics (CFD) is maturing, and is at a stage in its technological life cycle in which it is now routinely applied to some rather complicated problems; it is starting to create an impact on the design cycle of aerospace flight vehicles and their components. CFD is also being used to better understand the fluid physics of flows heretofore not understood, such as three-dimensional separation. CFD is also being used to complement and is being complemented by experiments. In this paper, the primary and secondary pacing items that govern CFD in the past are reviewed and updated. The future prospects of CFD are explored which will offer people working in the discipline challenges that should extend the technological life cycle to further increase the capabilities of a proven demonstrated technology. Author

N86-28058*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VORTEX SIMULATION OF FORCED MIXING LAYERS

Osamu Inoue and Anthony Leonard Jun. 1986 71 p
(NASA-TM-88235; A-86191; NAS 1.15:88235) Avail: NTIS HC A04/MF A01 CSCL 01A

Two-dimensional, spatially growing, turbulent mixing layers are simulated numerically by a vortex method and the results are compared with those determined experimentally. The effects of artificial forcing on flow development are also studied. Many of the flow features which have been observed experimentally are reproduced, and good quantitative agreements between experiments and computations are obtained. Author

N86-28059*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL STUDY OF FLOW DEFLECTORS DESIGNED TO ALLEVIATE GROUND WINDS INDUCED BY EXHAUST OF 80-BY 120-FOOT WIND TUNNEL
Vernon J. Rossow, Gene I. Schmidt, Michael S. Reinath, Johannes M. VanAken (Kansas Univ., Lawrence), Cynthia L. Parrish, and Raymond F. Schuler Jan. 1986 43 p
(NASA-TM-88195; A-86055; NAS 1.15:88195) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental study directed at finding a deflector ramp that will reduce to an acceptable level the ground winds under the exhaust jet of the 80 by 120 Foot Wind Tunnel at NASA Ames Center is described. A one-fifieth scale model of the full-scale facility was used to investigate how the jet flow field was modified by the various design parameters of the ramp. It was concluded that the ground winds were alleviated sufficiently by a ramp with end plates located next to the wind tunnel building along the ground edge of the exhaust opening. At full scale, the ramp should have a slant length of 7.62 m (25 ft) or more, and would be elevated at about 45 degrees to the ground plane. The material should have holes less than 15.2 (6 in) in diameter distributed uniformly over its surface to produce a porosity of about 30%. Author

N86-28060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ROTOR/WING AERODYNAMIC INTERACTIONS IN HOVER
Fort F. Felker and Jeffrey S. Light May 1986 27 p Presented at the 42nd Annual Forum of the American Helicopter Society, 2-4 Jun. 1986
(NASA-TM-88255; A-86246; NAS 1.15:88255) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental and theoretical investigation of rotor/wing aerodynamic interactions in hover is described. The experimental investigation consisted of both a large-scale and small-scale test. A 0.658-scale, V-22 rotor and wing was used in the large-scale test. Wind download, wing surface pressure, rotor performance, and rotor downwash data from the large-scale test are presented. A small-scale experiment was conducted to determine how changes in the rotor/wing geometry affected the aerodynamic interactions. These geometry variations included the distance between the rotor and wing, wing incidence angle, and configurations both with the rotor axis at the tip of the wing (tilt rotor configuration) and with the rotor axis at the center of the wing (compound helicopter configuration). A wing with boundary-layer control was also tested to evaluate the effect of leading and trailing edge upper surface blowing on the wing download. A computationally efficient, semi-empirical theory was developed to predict the download on the wing. Finally, correlations between the theoretical predictions and test data are presented. Author

N86-28061*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USING THE BOUNDARY-LAYER EQUATION IN 3-DIMENSIONAL VISCOUS FLOW SIMULATION
William R. VanDalsem and Joseph L. Steger Mar. 1986 15 p Presented at the AGARD Symposium on Applications of CFD in Aeronautics, Aix en Provence, France, 7-10 Apr. 1985
(NASA-TM-88241; A-86203; NAS 1.15:88241) Avail: NTIS HC A02/MF A01 CSCL 01A

A simple and computationally efficient algorithm for solving the unsteady three dimensional boundary layer equations in a time accurate or relaxation mode is presented. The algorithm is used to compute the separated flow over a 6:1 ellipsoid at angle of attack and the transonic flow over a finite wing with shock induced separation. These results are compared to available experimental data. A method of using the boundary layer algorithm to accelerate a Navier-Stokes computation is also presented. Example computations indicate that a boundary layer algorithm can be used to improve both the accuracy and efficiency of a Navier-Stokes algorithm. Author

N86-28062*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PATCHED-GRID CALCULATIONS WITH THE EULER AND NAVIER-STOKES EQUATIONS: THEORY AND APPLICATIONS
M. M. Rai Feb. 1986 105 p Presented at the Lecture Series on CFD, Rhode-St-Genese, Belgium, 3-7 Mar. 1986
(NASA-TM-88228; Rept-86112; NAS 1.15:88228) Avail: NTIS HC A06/MF A01 CSCL 01A

A patched-grid approach is one in which the flow region of interest is divided into subregions which are then discretized independently using existing grid generator. The equations of motion are integrated in each subregion in conjunction with patch-boundary schemes which allow proper information transfer across interfaces that separate subregions. The patched-grid approach greatly simplifies the treatment of complex geometries and also the addition of grid points to selected regions of the flow. A conservative patch-boundary condition that can be used with explicit, implicit factored and implicit relaxation schemes is described. Several example calculations that demonstrate the capabilities of the patched-grid scheme are also included. Author

N86-28063*# United Technologies Research Center, East Hartford, Conn.
MEASUREMENTS OF A TURBULENT HORSESHOE VORTEX FORMED AROUND A CYLINDER Final Report
W. A. Eckerle and L. S. Langston (Connecticut Univ., Storrs) Washington NASA Jun. 1986 206 p
(Grant NsG-3238)
(NASA-CR-3986; E-3027; NAS 1.26:3986) Avail: NTIS HC A10/MF A01 CSCL 01A

An experimental investigation was conducted to characterize a symmetrical horseshoe vortex system in front of and around a single large-diameter right cylinder centered between the sidewalls of a wind tunnel. Surface flow visualization and surface static pressure measurements as well as extensive mean velocity and pressure measurements in and around the vortex system were acquired. The results lend new insight into the formation and development of the vortex system. Contrary to what has been assumed previously, a strong vortex was not identified in the streamwise plane of symmetry, but started a significant angular distance away from it. Rather than the multiple vortex systems reported by others, only a single primary vortex and saddle point were found. The scale of the separation process at the saddle point was much smaller than the scale of the approaching boundary layer thickness. Results of the present study not only shed light on such phenomena as the nonsymmetrical endwall flow in axial turbomachinery but can also be used as a test case for three-dimensional computational fluid mechanics computer codes.
Author

N86-28064*# Old Dominion Coll., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
AN INVESTIGATION OF THE FEASIBILITY OF ACTIVE BOUNDARY LAYER THICKENING FOR AIRCRAFT DRAG REDUCTION Final Report, period ending 3 Mar. 1986
Robert L. Ash and C. Koodalattupuram Apr. 1986 15 p
(Grant NAG1-121)
(NASA-CR-177133; NAS 1.26:177133) Avail: NTIS HC A02/MF A01 CSCL 01A

The feasibility of using a forward mounted windmilling propeller to extract momentum from the flow around an axisymmetric body to reduce total drag has been studied. Numerical calculations

indicate that a net drag reduction is possible when the energy extracted is returned to an aft mounted pusher propeller. However, net drag reduction requires very high device efficiencies. Results of an experimental program to study the coupling between a propeller wake and a turbulent boundary layer are also reported. The experiments showed that a complex coupling exists and simple models for the flow field are not sufficiently accurate to predict total drag. Author

N86-28065# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abt. Hochgeschwindigkeitsstroemungen.
DIRECT CALCULATION OF WALL INTERFERENCES AND WALL ADAPTATION FOR TWO-DIMENSIONAL FLOW IN WIND TUNNELS WITH CLOSED WALLS
Juergen Amecke Nov. 1985 106 p In GERMAN; ENGLISH summary
(DFVLR-FB-85-62; ISSN-0171-1342; ESA-86-96882) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 29

A method for the direct calculation of the wall induced interference velocity in two dimensional flow based on Cauchy's integral formula was derived. This one-step method allows the calculation of the residual corrections and the required wall adaptation for interference-free flow starting from the wall pressure distribution without any model representation. Demonstrated applications are given. ESA

N86-28066# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
TRANSONIC AND SUPERSONIC WIND TUNNEL TESTS ON SCHEMATIC MISSILE CONFIGURATIONS WITH TWO DIFFERENT NOSE LENGTHS
Sven Erik Gudmundson and Lars Torngren Sep. 1985 93 p
(Contracts FMV-F-K-82223-75-007-07-001; FMV-F-K-82223-76-001-21-001)
(FFA-TN-1984-62; ESA-86-97051) Avail: NTIS HC A05/MF A01

A wind tunnel investigation at transonic and supersonic speeds for schematic missile models including body alone, body-tail, body-wing, and body-wing-tail configurations was performed. The test gives symmetric force and moment coefficients for an angle of attack range of 0 to 24 deg at Mach numbers from 0.7 to 2.99. Two different ogival noses with length/diameter ratio 3.5 and 1.5 were used. The influence of the nose length on normal force, pitching moment and axial force was studied. Examples of effects on asymmetric coefficients are given. ESA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-28067# Mitre Corp., McLean, Va.
PROCEDURES FOR CAUSE ORIENTED ANALYSIS AND CONSEQUENCE ORIENTED ANALYSIS
Alvin L. McFarland, Yan-Shek Hoh, and Gerald A. Dorfman Jun. 1986 26 p
(Contract DTFA01-84-C-0001)
(DOT/FAA/PM-86/21) Avail: NTIS HC A03/MF A01

Cause and consequence oriented analyses are techniques for safety analysis of software. They are particularly important for analyzing software whose inadequate performance could result in hazard to life or property. This report presents procedures for performing these analyses. Author

N86-28068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIME-BASED AIR TRAFFIC MANAGEMENT USING EXPERT SYSTEMS
L. Tobias and J. L. Scoggins Apr. 1986 59 p
(NASA-TM-88234; A-86188; NAS 1.15:88234) Avail: NTIS HC A04/MF A01 CSCL 07G

A prototype expert system was developed for the time scheduling of aircraft into the terminal area. The three functions of the air traffic control schedule advisor are as follows: first, for each new arrival, it develops an admissible flight plan for that aircraft. Second, as the aircraft progresses through the terminal area, it monitors deviations from the flight plan and provides advisories to return the aircraft to its assigned schedule. Third, if major disruptions such as missed approaches occur, it develops a revised plan. The advisor is operational on a Symbolics 3600, and is programed in MRS (a logic programming language), Lisp, and FORTRAN. Author

N86-28069# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: CHINA AIRLINES BOEING 747-SP, N4522V 300 NAUTICAL MILES NORTHWEST OF SAN FRANCISCO, CALIFORNIA, FEBRUARY 19, 1985
29 Mar. 1986 48 p
(PB86-910403; NTSB-AAR-86-03) Avail: NTIS HC A03/MF A01; also available on subscription, North American continent HC $60.00/year; all others write for quote CSCL 01B

About 1016 Pacific standard time February 19, 1985, China Airlines Flight 006, a Boeing 747 SP-09, enroute to Los Angeles, California from Taipei, Taiwan, suffered an inflight upset. The flight from Taipei to about 300 nmi northwest of San Francisco was uneventful and the airplane was flying at about 41,000 feet mean sea level when the No. 4 engine lost power. The National Transportation Safety Board determines that the probable cause of the accident was the captain's preoccupation with an inflight malfunction and his failuare to monitor properly the airplane's flight instruments which resulted in his losing control of the airplane. Contributing to the accident was the captain's over-reliance on the autopilot after the loss of thrust on the No. 4 engine. GRA

N86-28070# National Transportation Safety Board, Washington, D. C. Bureau of Field Operations.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT US CIVIL AND FOREIGN AVIATION, ISSUE NUMBER 10 OF 1984 ACCIDENTS
16 Dec. 1985 406 p
(PB86-916906; NTSB-AAB-86-06) Avail: NTIS HC A18/MF A01; also available on subscription, North American continent HC $185.00/year; all others write for quote CSCL 01B

Selected aircraft accident reports in brief format occurring in U.S. civil and foreign aviation operations during Calendar Year 1984 are given. Approximately 200 general aviation and air carrier accidents represent a random selection. The facts, conditions, circumstances and probable cause(s) for each accident are given. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-28071# Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
A STUDY OF DOPPLER LOGS FOR USE AS A SHIP'S NAVIGATIONAL AID
P. N. Denbigh 1978 48 p
(ACO-TR-4211; BR96381; ESA-86-97108) Avail: Issuing Activity

The use of acoustic Doppler logs to provide an instantaneous readout of ship's velocity and thus a dead reckoning technique to give the distance travelled is considered. Principles and limitations of the Doppler technique, and causes of inaccuracies are discussed.

The problem of Doppler log transmissions being detected by enemy sonars is examined. It is shown that, in spite of the high operating frequency where sound attenuation is very considerable in water, there are nonlinear effects in the water which can cause low frequency signals to be generated and propagated. These are shown to be of a magnitude likely to be detected. However, fairly simple modifications can be made to the Doppler log which greatly reduce the magnitude of these low frequency signals. ESA

N86-28072 Technische Hogeschool, Delft (Netherlands). Afdel. der Elektrotechniek.
LECTURE NOTES: ELECTRONIC NAVIGATION 2 (RADAR) [ELEKTRONISCHE NAVIGATIE 2]
E. Goldbohm 1986 191 p In DUTCH
(ESA-86-96951) Avail: Issuing Activity

The radar equation, related magnitudes such as signal detection, scanning and collapsing loss, and scattering cross section are introduced. Resolution, exactitude, and forms of clutter (e.g., ground, sea, and rain) are analyzed using the ambiguity function. Different types of radar (e.g., tracking, side looking, Doppler, and pulse radar) and their application possibilities and limitations, are discussed. ESA

N86-28073# Ohio Univ., Athens. Dept. of Electrical and Computer Engineering.
SITING CRITERIA FOR MICROWAVE LANDING SYSTEMS (MLS) Final Report
Roger Radcliff and Michael F. DiBenedetto Jun. 1986 83 p
(Contract DTRS57-83-C-00097)
(FAA/PM-86/18; OU-AEC-81-1) Avail: NTIS HC A05/MF A01

Current siting criteria for the Microwave Landing System (MLS) are described. These criteria were obtained throught flight testing, mathematical and computer modeling, and publications from other sources. A description of MLS principles and a technical description of each of the systems components are provided. General principles germane to siting, such as critical areas and propagation effects are introduced. The criteria for siting in the MLS in an ideal airport are described. Solutions to difficult siting problems such as MLS/ILS collocation, multipath and shadowing effects, and collocation with approach lighting systems are given. Author

N86-28074*# Boeing Commercial Airplane Co., Seattle, Wash.
LOCAL FLOW MANAGEMENT/PROFILE DESCENT ALGORITHM. FUEL-EFFICIENT, TIME-CONTROLLED PROFILES FOR THE NASA TSRV AIRPLANE
J. L. Groce, K. H. Izumi, C. H. Markham, R. W. Schwab, and J. L. Thompson May 1986 126 p
(Contract NAS1-14880)
(NASA-CR-172593; NAS 1.26:172593) Avail: NTIS HC A07/MF A01 CSCL 17G

The Local Flow Management/Profile Descent (LFM/PD) algorithm designed for the NASA Transport System Research Vehicle program is described. The algorithm provides fuel-efficient altitude and airspeed profiles consistent with ATC restrictions in a time-based metering environment over a fixed ground track. The model design constraints include accommodation of both published profile descent procedures and unpublished profile descents, incorporation of fuel efficiency as a flight profile criterion, operation within the performance capabilities of the Boeing 737-100 airplane with JT8D-7 engines, and conformity to standard air traffic navigation and control procedures. Holding and path stretching capabilities are included for long delay situations. Author

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-28075*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOADS CALIBRATIONS OF STRAIN GAGE BRIDGES ON THE DAST PROJECT AEROELASTIC RESEARCH WING (ARW-2)
Clinton V. Eckstrom Mar. 1986 118 p
(NASA-TM-87677; NAS 1.15:87677) Avail: NTIS HC A06/MF A01 CSCL 01C

Results from and details of the procedure used to calibrate strain gage bridges for measurements of wing structural loads, shear (V), bending moment (M_b), and torque (T), at three semi-span stations on both the left and right semispans of the ARW-2 wing are presented. The ARW-2 wing has a reference area of 35 square feet, a span of 19 feet, an aspect ratio of 10.3, a midchord line sweepback angle of 25 degrees, and a taper ratio of 0.4. The ARW-2 wing was fabricated using aluminum spars and ribs covered with a fiberglass/honeycomb sandwich skin material. All strain gage bridges are mounted along with an estimate of their accuracy by means of a comparison of computed loads versus actual loads for three simulated flight conditions. Author

N86-28076*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASTRAN/FLEXSTAB PROCEDURE FOR STATIC AEROELASTIC ANALYSIS
Lawrence S. Schuster Sep. 1984 21 p
(NASA-TM-84897; NAS 1.15:84897) Avail: NTIS HC A02/MF A01 CSCL 01C

Presented is a procedure for using the FLEXSTAB External Structural Influence Coefficients (ESIC) computer program to produce the structural data necessary for the FLEXSTAB Stability Derivatives and Static Stability (SD&SS) program. The SD&SS program computes trim state, stability derivatives, and pressure and deflection data for a flexible airplane having a plane of symmetry. The procedure used a NASTRAN finite-element structural model as the source of structural data in the form of flexibility matrices. Selection of a set of degrees of freedom, definition of structural nodes and panels, reordering and reformatting of the flexibility matrix, and redistribution of existing point mass data are among the topics discussed. Also discussed are boundary conditions and the NASTRAN substructuring technique. Author

N86-28077*# McDonnell-Douglas Corp., Long Beach, Calif.
EVALUATION OF LAMINAR FLOW CONTROL SYSTEMS CONCEPTS FOR SUBSONIC COMMERCIAL TRANSPORT AIRCRAFT Final Report
W. E. Pearce Jun. 1983 504 p
(Contract NAS1-14632)
(NASA-CR-159251; NAS 1.26:159251; ACEE-01-FR-3132) Avail: NTIS HC A22/MF A01 CSCL 01C

An evaluation was made of laminar flow control (LFC) system concepts for subsonic commercial transport aircraft. Configuration design studies, performance analyses, fabrication development, structural testing, wind tunnel testing, and contamination-avoidance techniques were included. As a result of trade studies, a configuration with LFC on the upper wing surface only, utilizing an electron beam-perforated suction surface, and employing a retractable high-lift shield for contamination avoidance, was selected as the most practical LFC system. The LFC aircraft was then compared with an advanced turbulent aircraft designed for the same mission. This comparison indicated significant fuel savings and reduced direct operating cost benefits would result from using LFC. Author

N86-28078*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.
APPLICATION OF PARAMETER ESTIMATION TO HIGHLY UNSTABLE AIRCRAFT
Richard E. Maine and James E. Murray Aug. 1986 14 p Proposed for presentation at the AIAA Atmospheric Flight Mechanics Conference, Williamsburg, Va., 18-20 Aug. 1986
(NASA-TM-88266; H-1365; NAS 1.15:88266; AIAA-86-2020-CP) Avail: NTIS HC A02/MF A01 CSCL 01C

The application of parameter estimation to highly unstable aircraft is discussed. Included are a discussion of the problems in applying the output error method to such aircraft and demonstrates that the filter error method eliminates these problems. The paper shows that the maximum likelihood estimator with no process noise does not reduce to the output error method when the system is unstable. It also proposes and demonstrates an ad hoc method that is similar in form to the filter error method, but applicable to nonlinear problems. Flight data from the X-29 forward-swept-wing demonstrator is used to illustrate the problems and methods discussed. Author

N86-28079*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF BLADE-TO-BLADE DISSIMILARITIES ON ROTOR-BODY LEAD-LAG DYNAMICS

Michael J. McNulty Mar. 1986 31 p
(Contract K-1053)
(NASA-TM-86828; A-85393; NAS 1.15:86828; USAAVSCOM-TM-86-A-3) Avail: NTIS HC A03/MF A01 CSCL 01C

Small blade-to-blade property differences are investigated to determine their effects on the behavior of a simple rotor-body system. An analytical approach is used which emphasizes the significance of these effects from the experimental point of view. It is found that the primary effect of blade-to-blade dissimilarities is the appearance of additional peaks in the frequency spectrum which are separated from the convention response modes by multiples of the rotor speed. These additional responses are potential experimental problems because when they occur near a mode of interest they act as contaminant frequencies which can make damping measurements difficult. The effects of increased rotor-body coupling and a rotor shaft degree of freedom act to improve the situation by altering the frequency separation of the modes. Author

N86-28080# Aeronautical Research Labs., Melbourne (Australia).

MIRAGE A3-002 STRAIN RESPONSES TO GROUND CALIBRATION LOADINGS BETWEEN 1978 AND 1985

M. G. J. Higgs Dec. 1985 116 p
(AD-A165846; ARL-STRUC-TM-425) Avail: NTIS HC A06/MF A01 CSCL 01/3

Prior to flight trials in 1978, a calibration of strain gauges fitted to Mirage A3-002 was carried out by measuring responses to ground loads applied at several locations on the Mirage wing. Since 1978, further ground calibrations have been made on the same aircraft. The loading procedure used was similar to that for earlier ground calibrations of other Mirage aircraft. This technical memorandum provides a record of the output of strain gauges fitted to A3-002, and identifies some trends in these outputs. For some gauges, data is given for a seven-year period. Two loading cases are presented: (1) loading at the main external store attachment point, and (2) loading at the Sidewinder attachment point. The discussion is restricted to strain gauges fitted to wings and to fuselage frame 26. In general, consistent results were obtained over the measurement period. GRA

N86-28081# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

PROBABILISTIC DAMAGE TOLERANCE ANALYSIS OF AIRCRAFT STRUCTURES

Bjoern Palmberg, Anders F. Blom, and Sigge Eggwertz Nov. 1985 136 p Submitted for publication
(Contract STU-84-4563)
(FFA-TN-1985-68; ESA-86-97055) Avail: NTIS HC A07/MF A01

The state of the art in probabilistic damage tolerance analysis was reviewed. A probabilistic model for fatigue life prediction based on existing models for probabilistic characterization of initial flaw sizes, fatigue crack growth and failure was developed. The effect of periodic inspections is taken into account. A numerical example which shows practical difficulties involved in the analysis, but also the advantage of inspections from a safety point of view is included. ESA

N86-28082# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Div. Avions.

THE DESIGN OF COMPOSITE STRUCTURES [LA CONCEPTION DES STRUCTURES COMPOSITES]

G. Hellard 13 Feb. 1985 22 p In FRENCH Presented at 1st Bonded Aircraft Struct. Tech. Appl. and Repairs Tech. Congr., Seeheim, West Ger., 23 Jan. 1985
(SNIAS-861-111-103; GCO/GH/CL-442.026/85; ESA-86-97140) Avail: NTIS HC A02/MF A01

The principles of aircraft element design using composite materials are outlined. Glass carbon and Kevlar composites are discussed. Sandwich and monolothic structures are described and application criteria are detailed. Drawings detailing the composite elements of the A-310 to A-330 and ATR-42 aircrafts and the particular design of those elements are presented. ESA

N86-28083# Societe Nationale Industrielle Aerospatiale, Toulouse (France).

THE SIGMA CADCAM SOFTWARE [SIGMA, LOGICIEL DE CFAO]

R. Gandou and P. Jubert 16 Dec. 1985 14 p In FRENCH Presented at Congr. on Le Calcul Domain, Grenoble, France, 6 Dec. 1985 Submitted for publication
(SNIAS-861-111-110; ESA-86-97146) Avail: NTIS HC A02/MF A01

A software system for designing and handling complex three-dimensional shapes based on a polynomial representation of curves and surfaces derived from Bezier-Berstein functions is described. Applications include aviation (designing wings, forward fuselages, wing-fuselage joints, engine pods and pylons) ship building (designing hulls) the automobile industry (bodywork), and all industries for which the design of shapes raises complex problems, requiring considerable interactivity, extremely good computation accuracy, and manipulation of surfaces by blending, cutting out, etc. The man machine dialog; the creation of shapes; the exploitation of shapes; and manufacture are discussed. ESA

N86-28084# Societe Nationale Industrielle Aerospatiale, Marignane (France). Structures Dept.

COMPUTING CODES FOR DEVELOPMENT OF HELICOPTER CRASHWORTHY STRUCTURES AND TEST SUBSTANTIATION

J. Mens and J. C. Bianchini (Engineering System International, Rungis, France) 1986 14 p Presented at AHS/NAI Intern. Seminar, Nanjing, China, 6-8 Jan. 1985 Sponsored by Direction des Recherches Etudes et Techniques
(SNIAS-861-210-106; ESA-86-97154) Avail: NTIS HC A02/MF A01

Computing tools used in designing crashworthy helicopters are described. The dynamic behavior of components during impact on ground is computed by the KRASH program. The buckling load of panels stiffened by angles, Z-sections, or honeycomb panels, is computed by a purely analytic computer code. The complete buckling and post-buckling behavior of the structure components can be successfully described by the PAM CRASH computer program system, taking account of specific support and contact conditions as well as possible interaction between fluid and structure; the programs use the finite element method in large deformations and the nonlinear behavior of materials. In static or slightly dynamic analyses, an implicit integration scheme is used. For higher velocity impact, an explicit scheme is more effective. Hybridization of the analytical model within an implicit numerical code gives results which are very comparable with a purely numerical calculation, but at lower cost. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-28085*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

UNIFORM ENGINE TESTING PROGRAM PHASE 7: NASA LEWIS RESEARCH CENTER SECOND ENTRY

T. J. Biesiadny, L. A. Burkardt, M. Abdelwahab, W. M. Braithwaite, T. A. Kirchgessner, and D. Silver Jul. 1986 69 p

(NASA-TM-87272; E-2971; NAS 1.15:87272) Avail: NTIS HC A04/MF A01 CSCL 21E

The propulsion and Energetics Panel, Working Group 15, of the Advisory Group for Aerospace Research and Development (AGARD) is sponsoring a Uniform Engine Testing Program (UETP). In this program, two jet engines were tested under identical conditions in certain NATO altitude and ground-level facilities as a means of correlating these facilities. With this second entry, NASA documented engine deterioration that may have occurred since inception of the UETP. Additionally, NASA investigated anomalies discovered during review of data from the five facilities which had participated in the program between the two NASA entries. Author

N86-28086*# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.

LATERAL JET INJECTION INTO TYPICAL COMBUSTOR FLOWFIELDS

David G. Lilley Washington NASA Jul. 1986 97 p

(Grant NAG3-549)

(NASA-CR-3997; NAS 1.26:3997) Avail: NTIS HC A05/MF A01 CSCL 21E

The experimental problem of lateral jet injection into typical flow fields in the absence of combustion was studied. All flow fields being investigated have no expansion of the crossflow (the test section to swirler diameter ratio D/d = 1), after its passage through an optional swirler (with swirl vane angle phi = 0 (swirler removed), 45, and 70 degree). The lateral jet(s) is(are) located one test-section diameter downstream of the test-section inlet (x/D = 1). The lateral jets have round-sectioned nozzles, each of which has an area of 1/100th of the cross sectional area of the crossflow (A sub j/A sub c = 1/100). Jet-to-crossflow velocity ratios of R = v sub j/u sub o = 2, 4, and 6 were investigated. Helium-bubble low visualization, five-hole pitot probe time-mean velocity measurements, and single-wire time-mean velocity and normal and shear stress turbulence data were obtained in the research program. Author

N86-28087*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

EFFECTS OF SURFACE CHEMISTRY ON HOT CORROSION LIFE Final Report

R. E. Fryxell and G. E. Leese (TRW, Inc., Cleveland, Ohio.) Jun. 1986 113 p

(Contract NAS3-23926)

(NASA-CR-179471; NAS 1.26:179471; R86AEB361) Avail: NTIS HC A06/MF A01 CSCL 21E

Burner rig tests were conducted under the following conditions: 900 C, hourly thermal cycling, 0.5 ppm sodium as NaCl in the gas stream, and Mach 0.3 velocity. The alloys tested were Udimet 700 (U700) and Rene 80, uncoated and with RT21, Codep, or NiCoCrAlY coatings. The tests, up to 1000 hours, included specimens in the as-processed condition and after aging at 1100 C in oxidizing or inert environments for up to 600 hours. Coil-inductance changes were measured for periodic nondestructive inspection of speciments and found useful in the following course of corrosion. Typical sulfidation observed in all cases was similar to that observed in service-run turbine components. Aging at 1100 C caused severe decrease in the hot corrosion life of RT21 and Codep coatings and a significant but lesser decrease in the life of NiCoCrAlY coatings. The extent of these decreases was much greater for all three coatings on U700 than on Rene substrates. A coating hot corrosion life-predicitin model was proposed. The model requires time/temperature information for a turbine component at takeoff conditions as well as environmental contaminant information. Author

N86-28088*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.

TEST AND EVALUATION OF THE HIDEC ENGINE UPTRIM ALGORITHM

Ronald J. Ray and Lawrence P. Myers Jul. 1986 13 p Presented at the AIAA/ASME/SAE/ASEE 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986

(NASA-TM-88262; H-1363; NAS 1.15:88262) Avail: NTIS HC A02/MF A01 CSCL 21E

The highly integrated digital electronic control (HIDEC) program will demonstrate and evaluate the improvements in performance and mission effectiveness that result from integrated engine-airframe control systems. Performance improvements will result from an adaptive engine stall margin mode, a highly integrated mode that uses the airplane flight conditions and the resulting inlet distortion to continuously compute engine stall margin. When there is excessive stall margin, the engine is uptrimmed for more thrust by increasing engine pressure ratio (EPR). The EPR uptrim logic has been evaluated and implemented into computer simulations. Thrust improvements over 10 percent are predicted for subsonic flight conditions. The EPR uptrim was successfully demonstrated during engine ground tests. Test results verify model predictions at the conditions tested. Author

N86-28089*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.

ON THE MODELING OF LOW-REYNOLDS-NUMBER TURBULENCE Final Report

Ronald M. C. So and G. J. Yoo Washington NASA Jul. 1986 143 p

(Grant NAG3-167; Contract NG0530-85-C-0191)

(NASA-CR-3994; E-3059; NAS 1.26:3994; CR-R85033) Avail: NTIS HC A07/MF A01 CSCL 21E

A full Reynolds-stress closure that is capable of describing the flow all the way to the wall was formulated for turbulent flow through circular pipe. Since viscosity does not appear explicitly in the pressure redistribution terms, conventional high-number models for these terms are found to be applicable. However, the models for turbulent diffusion and viscous dissipation have to be modified to account for viscous diffusion near a wall. Two redistribution and two diffusion models are investigated for their effects on the model calculations. Wall correction to pressure redistribution modeling is also examined. Diffusion effects on calculated turbulent properties are further investigated by simplifying the transport equations to algebraic equations for Reynolds stress. Two approximations are explored. These are the equilibrium and nonequilibrium turbulence assumptions. Finally, the two-equation closure is also used to calculate the flow in question and the results compared with all the other model calculations. Fully

developed pipe flows at two moderate Reynolds numbers are used to validate these model calculations. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-28090*# Alphatech, Inc., Burlington, Mass.
INITIAL DESIGN AND EVALUATION OF AUTOMATIC RESTRUCTURABLE FLIGHT CONTROL SYSTEM CONCEPTS
Jerold L. Weiss, Douglas P. Looze, John S. Eterno, and Daniel B. Grunberg Jun. 1986 163 p
(Contract NAS1-17411)
(NASA-CR-178064; NAS 1.26:178064; AI-TR-269) Avail: NTIS HC A08/MF A01 CSCL 01C

Results of efforts to develop automatic control design procedures for restructurable aircraft control systems is presented. The restructurable aircraft control problem involves designing a fault tolerance control system which can accomodate a wide variety of unanticipated aircraft failure. Under NASA sponsorship, many of the technologies which make such a system possible were developed and tested. Future work will focus on developing a methodology for integrating these technologies and demonstration of a complete system. Author

N86-28091*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.
SIMULATION STUDIES OF ALTERNATE LONGITUDINAL CONTROL SYSTEMS FOR THE SPACE SHUTTLE ORBITER IN THE LANDING REGIME
Bruce G. Powers and Shahan K. Sarrafian 1986 14 p Proposed for presentation at the AIAA Atmospheric Flight Mechanics Conference, Williamsburg, Va., 18-20 Aug. 1986
(NASA-TM-86815; H-1356; NAS 1.15:86815) Avail: NTIS HC A02/MF A01 CSCL 01C

Simulations of the space shuttle orbiter in the landing task were conducted by the NASA Ames-Dryden Flight Research Facility using the Ames Research Center vertical motion simulator (VMS) and the total in-flight simulator (TIFS) variable-stability aircraft. Several new control systems designed to improve the orbiter longitudinal response characteristics were investigated. These systems improved the flightpath response by increasing the amount of pitch-rate overshoot. Reduction in the overall time delay was also investigated. During these evaluations, different preferences were noted for the baseline or the new systems depending on the pilot background. The trained astronauts were quite proficient with the baseline system and found the new systems to be less desirable than the baseline. On the other hand, the pilots without extensive flight training with the orbiter had a strong preference for the new systems. This paper presents the results of the VMS and TIFS simulations. A hypothesis is presented regarding the control strategies of the two pilot groups and how this influenced their control systems preferences. Interpretations of these control strategies are made in terms of open-loop aircraft response characteristics as well as pilot-vehicle closed-loop characteristics. Author

N86-28092*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.
EFFECT OF TIME DELAY ON FLYING QUALITIES: AN UPDATE
Rogers E. Smith and Shahan K. Sarrafian Aug. 1986 13 p Proposed for presentation at the AIAA Guidance, Navigation and Control Conference, Williamsburg, Va., 18-20 Aug. 1986
(NASA-TM-88264; H-1351; NAS 1.15:88264) Avail: NTIS HC A02/MF A01 CSCL 01C

Flying qualities problems of modern, full-authority electronic flight control systems are most often related to the introduction of additional time delay in aircraft response to a pilot input. These delays can have a significant effect on the flying qualities of the aircraft. Time delay effects are reexamined in light of recent flight test experience with aircraft incorporating new technology. Data from the X-29A forward-swept-wing demonstrator, a related preliminary in-flight experiment, and other flight observations are presented. These data suggest that the present MIL-F-8785C allowable-control system time delay specifications are inadequate or, at least, incomplete. Allowable time delay appears to be a function of the shape of the aircraft response following the initial delay. The cockpit feel system is discussed as a dynamic element in the flight control system. Data presented indicate that the time delay associated with a significant low-frequency feel system does not result in the predicted degradation in aircraft flying qualities. The impact of the feel system is discussed from two viewpoints: as a filter in the control system which can alter the initial response shape and, therefore, the allowable time delay, and as a unique dynamic element whose delay contribution can potentially be discounted by special pilot loop closures. Author

N86-28093*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IMPLEMENTATION AND FLIGHT TESTS FOR THE DIGITAL INTEGRATED AUTOMATIC LANDING SYSTEM (DIALS). PART 2: COMPLETE SET OF FLIGHT DATA
Richard M. Hueschen Jul. 1986 330 p
(NASA-TM-87632-Pt-2; NAS 1.15:87632-Pt-2) Avail: NTIS HC A15/MF A01 CSCL 17G

Five flight tests of the Digital Automated Landing System (DIALS) were conducted on the Advanced Transport Operating System (ATOPS) Transportation Research Vehicle (TSRV)--a modified Boeing 737 Aircraft for advanced controls and displays research. These flight tests were conducted at NASA's Wallops Flight Center using the Microwave Landing System (MLS) installation on Runway 22. This report is primarily a collection of data plots of all performance variables recorded for the entire five flight tests. A description and source of the performance variables is included. Performance variables include inertial data, air data, automatic control commands, control servo positions, sensor data, DIALS guidance and control parameters, and Kalman filter data. This data illustrates low overshoot captures of the localizer for intercept angles of 20 deg, 30 deg, 40 deg, and 50 deg intercept angles, and low overshoot captures of the glideslope slope for 3 deg, 4.5 deg, and 5 deg glideslopes. Flare maneuvers were successfully performed from the various glideslope angles and good decrab maneuvers were performed in crosswinds of 6 knots. In 18 to 20 knot crosswind conditions rudder limiting occurred which caused lateral drifting although heading alignment was achieved. Author

N86-28094# Deutsche Lufthansa Aktiengesellschaft, Cologne (West Germany).
CONTROL SYSTEMS FOR THE AIRBUS DESIGN AND FUNCTIONAL EXPERIENCE [LEITSYSTEME FUER DEN AIRBUS. AUFBAU UND BETRIEBSERFAHRUNG]
Peter H. Heldt 1985 21 p In GERMAN Presented at Fachgespraechs der Gesellschaft fuer Reaktorsicherheit, Munich, West Germany, 8 Nov. 1985
(ESA-86-96936) Avail: NTIS HC A02/MF A01

The design of cockpits of modern passenger aircraft is illustrated by the Airbus 310. Basic rules of aircraft design are given. Important control systems are presented. The status of functional experience is outlined. The crew is taken into account as an integral part in order to correctly understand the global cockpit system. It is shown how the two tasks of pilots (flying and controlling) are integrated in the global concept of cockpit design, and the pilot qualifications required for these tasks are outlined. ESA

N86-28095# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
EIGENVALUES ASSIGNMENT METHOD: AN APPLICATION TO DESIGNING AN AUTOPILOT
A. Bucharles (Departement d'Etudes et de Recherches en

Technologie Spatiale, Toulouse, France), J. F. Magni, and O. Herail 1986 15 p In FRENCH; ENGLISH summary Presented at AFCET Salon Intern. des Tech. et Energies du Futur (SITEF 85), Toulouse, 24-25 Oct. 1985 Submitted for publication
(Contracts STPA-83-95024; STPA-84-95016)
(SNIAS-861-111-106; ESA-86-97143) Avail: NTIS HC A02/MF A01

Eigenstructure assignment methods are shown to be a useful tool for computing control laws of multivariable systems. In a first step closed loop eigenvalues are to be assigned. The second step uses the degrees of freedom available on the eigenvectors for optimizing criteria relative to control objectives as output shaping, insensitivity, or disturbance decoupling. The degrees of freedom of eigenvectors are defined and it is shown how to obtain control objectives. The design of an autopilot is detailed to demonstrate the method's efficiency. ESA

N86-28096# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
MAIN FLIGHT CONTROLS [COMMANDES DE VOL PRINCIPALES]
Michel Durandeau 1986 30 p In FRENCH Presented at Ecole Nationale de l'Aviation Civile Conf., Toulouse, 22 May 1985
(SNIAS-861-111-111; ESA-86-97147) Avail: NTIS HC A03/MF A01

The A-320 aircraft flight control and avionics systems are illustrated. Safety, maintenance, and systems engineering aspects are listed. ESA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-28097*# National Aeronautics and Space Administration, Washington, D.C.
WALL EFFECTS IN WIND TUNNELS
J. P. Chevallier and X. Vaucheret Jul. 1986 40 p Transl. into ENGLISH of conference paper "Effets de Parois en Soufflerie" rept. ONERA TP-1983-143 ONERA, Toulouse, France, presented at the 20th Colloquium on Applied Aerodynamics of the AAAF. 1983 p 1-31 Colloquium held in Toulouse, France, 8-10 Nov. 1983 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88447; NAS 1.15:88447) Avail: NTIS HC A03/MF A01 CSCL 14B

A synthesis of current trends in the reduction and computation of wall effects is presented. Some of the points discussed include: (1) for the two-dimensional, transonic tests, various control techniques of boundary conditions are used with adaptive walls offering high precision in determining reference conditions and residual corrections. A reduction in the boundary layer effects of the lateral walls is obtained at T2; (2) for the three-dimensional tests, the methods for the reduction of wall effects are still seldom applied due to a lesser need and to their complexity; (3) the supports holding the model of the probes have to be taken into account in the estimation of perturbatory effects. Author

N86-28098*# National Aeronautics and Space Administration, Washington, D.C.
INITIAL ADAPTATION TESTING OF THE BIDIMENSIONALLY SELF-ADAPTING WALL OF THE FRENCH T2 WIND TUNNEL, AROUND A THREE-DIMENSIONAL OBJECT
J. P. Archambaud, J. B. Dor, A. Mignosi, and L. Lamarche Jun. 1986 52 p Transl. into ENGLISH of "Premiers Essais d'Adaptation des Parois Auto-Adaptables Bidimensionnelles de la Soufflerie T2 Autour d'Obstacles Tridimensionnels" rept. OA-33/3075, DERAT-11/5015-DN ONERA, Toulouse, France, Sep. 1985 p 1-49 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88444; NAS 1.15:88444; OA-33/3075; DERAT-11/5015-DN) Avail: NTIS HC A04/MF A01 CSCL 14B

The test series was carried out at ONERA/CERT at the T2 wind tunnel in September 1984. The objective of this series was to minimize wall interference through a bidimensional adaptation around the models, inducing tridimensional flows. For this, three different models were used, measuring either the pressures or the forces and moment of pitch (balance). The adaptation was derived from a correction computation in the compressible axisymmetric tridimensional. Author

N86-28099*# National Aeronautics and Space Administration, Washington, D.C.
CRYOGENIC WIND TUNNELS: PROBLEMS OF CONTINUOUS OPERATION AT LOW TEMPERATURES
D. Faulmann Jun. 1986 52 p Transl. into ENGLISH of "Souffleries Cryogeniques Problemses Lies au Fonctionnement Continue en Basse Temperature" rept. OA-9/5007-AYD, DERAT-9/5007-DY ONERA, Toulouse, France, Jun. 1980 p 1-18 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88446; NAS 1.15:88446; OA-9/5007-AYD; DERAT-9/5007-DY) Avail: NTIS HC A03/MF A01 CSCL 14B

The design of a cryogenic wind tunnel which operates continuously, and is capable of attaining transonic speeds at generating pressures of about 3 bars is described. Its stainless steel construction with inside insulation allows for very rapid temperature variations promoted by rapid changes in the liquid nitrogen flow. A comparative study of temperature measuring probes shows a good reliability of thin sheet thermocouples. To measure fluctuations, only a cold wire makes it possible to record frequencies of about 300 Hz. The use of an integral computer method makes it possible to determine the impact of the wall temperature ratio to the adiabatic wall temperature for the various parameters characterizing the boundary layer. These cases are processed with positive and negative pressure gradients. Author

N86-28100*# National Aeronautics and Space Administration, Washington, D.C.
PROBLEMS ASSOCIATED WITH OPERATIONS AND MEASUREMENT IN CRYOGENIC WIND TUNNELS
A. Blanchard, V. Delcourt, and M. Plazanet Jun. 1986 75 p Transl. into ENGLISH of "Problemes Lies au Fonctionnement et aux Mesures en Soufflerie Cryogenique" rept. OA-13/5007-AYD, DERAT-13/5007-DY ONERA, Toulouse France, Jul. 1981 p 1-30 Transl. by Scientifc Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88443; NAS 1.15:88443; OA-13/5007-AYD; DERAT-13/5007-DY) Avail: NTIS HC A04/MF A01 CSCL 14B

Cryogenic wind tunnel T'3 under continuous blower operation has been the object of improvements and the installation of auxiliary equipment, dealing in particular with the enlargement of the liquid nitrogen injection reservoir and the hook-up to a fast data acquisition system. Following a brief description of the installation and its functioning, we present the main experimental techniques and the instrumentation used in the cryogenic environment. Author

N86-28101*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF TWO TURNING VANE DESIGNS FOR HIGH-SPEED CORNER OF 0.1-SCALE MODEL OF NASA LEWIS RESEARCH CENTER'S PROPOSED ALTITUDE WIND TUNNEL
Royce D. Moore, Donald R. Boldman, and Rickey J. Shyne Apr. 1986 130 p
(NASA-TP-2570; E-2831; NAS 1.60:2570) Avail: NTIS HC A07/MF A01 CSCL 14B

Two turning vane designs were experimentally evaluated for corner 1 (downstream of the test section) of a 0.1-scale model of the NASA Lewis Research Center's proposed Altitude Wind

Tunnel (AWT). Vane A was a controlled-diffusion airfoil shape; vane B was a circular-arc airfoil shape. The vane designs were tested over corner inlet Mach numbers from 0.16 to 0.465. Several modifications in vane setting angle and vane spacing were also evaluated for vane A. The overall performance obtained from total pressure rakes indicated that vane B had a slightly lower loss coefficient than vane A. At Mach 0.35 (the design Mach number without the engine exhaust removal scoop), the loss coefficients were 0.150 and 0.178 for vanes B and A, respectively. Resetting the vane A angle by -5 deg. (vane A10) to turn the flow toward the outside corner reduced the loss coefficient to 0.119. The best configuration (vane A10) was also tested with a simulated engine exhaust removal scoop. The loss coefficient for that configuration was 0.164 at Mach 0.41 (the approximate design Mach number with the scoop). Author

N86-28102# Department of the Navy, Washington, D. C.
AIRCRAFT BARRICADE Patent
Perry R. DiGiovanniantonio, inventor (to Navy) and William J. Zimmer, inventor (to Navy) Issued 28 Jan. 1986 4 p Supersedes AD-D011316
(AD-D012194; US-Patent-4,566,658; US-Patent-Appl-SN-519421; US-Patent-Class-244-110) Avail: US Patent and Trademark Office CSCL 01/5

A webbing system is disclosed for use as an aircraft barricade wherein a plurality of rectangularly-shaped engaging loops are arranged in an alternating, multi-planar array and suspended across a landing area in the path of an approaching aircraft upon an assembly of support loops stretched between a pair of stanchions and connected on either side to an energy absorbing device. Slidably connected along upper and lower horizontal components of the support loops, the engaging loops are free to move laterally along the support loops toward the longitudinal axis of the aircraft when penetrated by the fuselage so that the aircraft is ensnared about its wings by the loops with equalized loading and its forward motion arrested. GRA

N86-28103# Aeronautical Research Labs., Melbourne (Australia).
RIGID BODY STABILITY AUGMENTATION STUDIES FOR A WIND TUNNEL FLUTTER MODEL
C. J. Ludowyk Nov. 1985 47 p
(AD-A165847; ARL-STRUC-TM-426) Avail: NTIS HC A03/MF A01 CSCL 14/2

The report describes a simulation study undertaken in preparation for wind tunnel trials of flutter suppression control laws at DFVLR, Goettingen, West Germany. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-28104* National Aeronautics and Space Administration, Washington, D.C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS: A BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 14)
Jul. 1986 172 p
(NASA-SP-7046(14); NAS 1.21:7046(14)) Avail: NTIS HC A07 CSCL 22A

This bibliography lists 645 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1, 1985 and December 31, 1985. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design according to system, interactive analysis and design, structural and thermal analysis and design, structural concepts and control systems, electronics, advanced materials, assembly concepts, propulsion, and solar power satellite systems. Author

N86-28105* National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION SYSTEMS: A BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 2)
Jul. 1986 232 p
(NASA-SP-7056(02); NAS 1.21:7056(02)) Avail: NTIS HC A10 CSCL 22A

This bibliography lists 904 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1, 1985 and December 31, 1985. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design according to system, interactive analysis and design, structural and thermal analysis and design, structural concepts and control systems, electronics, advanced materials, assembly concepts, propulsion, and solar power satellite systems. The coverage includes documents that define major systems and subsystems, servicing and support requirements, procedures and operations, and missions for the current and future space station. Author

N86-28106*# National Aeronautics and Space Administration, Washington, D.C.
AN OVERVIEW OF DUTCH PARTICIPATION IN THE SPACELAB D1 MISSION AND THE COLUMBUS SPACE STATION PROJECT
Jun. 1986 12 p Transl. into ENGLISH from Ruimtevaart (Netherlands), no. 6, May 1986 p 22-37 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-87986; NAS 1.15:87986) Avail: NTIS HC A02/MF A01 CSCL 22A

Articles and a few short descriptions of recent developments in the field of space travel are discussed. Information on research and technology in space to facilitate contact between these two fields is provided. A description is given of the successful Spacelab D-1 flight and the standard instrument package. The Netherlands experiments in the D-1 mission, the next Spacelab flights, and the Columbus program are discussed. Author

N86-28107# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
WORKING IN SPACE. SPACELAB, MATERIALS RESEARCH AND ENGINEERING UNDER WEIGHTLESSNESS [DAS LABOR IM WELTRAUM: MATERIALFORSCHUNG UND VERFAHRENSTECHNIK UNTER SCHWERELOSIGKEIT]
Nov. 1985 58 p In GERMAN Original contains color illustrations
(ESA-86-96941) Avail: NTIS HC A04/MF A01

Materials research performed in the framework of the Spacelab programs is reviewed. Scientific and technical preparation, experimental programs in space, demonstration missions, and pilot projects are presented. The access of users to flight possibilities is explained. Research activities are listed. ESA

N86-28108# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
COMPARISON OF ALTERNATIVE STRATEGIES OF RETURN-TO-THE-MOON CASTOR
Uwe Apel, Bernd Johenning, H. Hermann Koelle, Buelent Alkan, Peter Koziol, Andreas Lindenthal, Udo Merk, Hinrich Rodatz, Bilhan Tuerkmen, Thomas Eckardt et al 20 Aug. 1985 111 p
(ILR-Mitt-154; ESA-86-96809) Avail: NTIS HC A06/MF A01

Strategies of constructing and supporting a permanent lunar base for 25 operational years with a crew of 6, 30, or 120 respectively were assessed. If initial development funding is available in 1991, beneficial occupancy of such lunar bases could occur in the 2001 to 2004 time bracket. The cost is estimated to be on the order of 56, 65, and 106 billion dollars (1985) respectively leading to a cost-effectiveness of 338, 83, and 33 million dollars (1985) per lunar man-year for these three alternatives. ESA

N86-28412*# Rome Univ. (Italy). Dipt. Fisica.
SCIENCE APPLICATIONS
Franco Mariani *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 117-126

(For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28413*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATIONS OF TETHERS FOR PLANETARY MISSIONS
Paul Penzo *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 127-151 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28415*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTRODYNAMIC INTERACTIONS
James McCoy *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 161-184 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28418*# Martin Marietta Aerospace, Denver, Colo.
TETHER APPLICATIONS FOR SPACE STATION
William Nobles *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 239-267 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28419*# Aeritalia S.p.A., Torino (Italy). Space Systems Group.
THE SCIENCE AND APPLICATIONS TETHERED PLATFORM (SATP) PROJECT
Pietro Merlina *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 269-278 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28420*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TECHNOLOGY AND TEST
Paul Siemers *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 279-283 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28421*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
TETHERED CONSTELLATIONS
Enrico Lorenzini *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 285-308 Pergammon Press Ltd. (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28423*# Los Alamos National Lab., N. Mex.
BISTATIC LIDAR EXPERIMENT PROPOSED FOR THE SHUTTLE/TETHERED SATELLITE SYSTEM MISSIONS
David J. McComas, Harlan E. Spense (California Univ., Los Angeles), Robert R. Karl, Henry G. Horak, and Thomas D. Wilkerson (Maryland Univ., College Park) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 329-347 American Inst. of Physics Repr. from Review of Scientific Instruments, v. 56, no. 5, May 1985 p 670-673 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28876*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Space Science Dept.
THE CASSINI MISSION TO SATURN AND TITAN. AN OVERVIEW
Jean-Pierre Lebreton *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 225-232 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28877*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE TOUR DESIGN FOR THE CASSINI MISSION
Roger E. Diehl *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 233-243 Presented at Workshop on Solid Bodies of the Outer Solar System, Vulcano, Italy, 9-13 Sep. 1985 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28879*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CASSINI: THE IMAGING EXPERIMENT
Torrence V. Johnson *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 261-265 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N86-28109# Bonn Univ. (West Germany). Geodaetischen Inst.
INVESTIGATIONS FOR THE IMPROVEMENT OF BROWNIAN MOON RANGES BASED ON THE VARIATIONS OF THE INTEGRATION CONSTANTS AND OTHER PARAMETERS Ph.D. Thesis [UNTERSUCHUNGEN ZUR VERBESSERUNG BROWNSCHER MONDENTFERNUNGEN AUFGRUND VON VARIATIONEN DER INTEGRATIONSKONSTANTEN UND ANDERER PARAMETER]
Klaus-Peter Stoffels 1985 134 p In GERMAN
(Rept-66; ISSN-0723-4325; ESA-86-96933) Avail: NTIS HC A07/MF A01

Possibilities to improve Moon theories to determine translational Moon motion were investigated, using Brown's Moon theory and later improvements (e.g., Eckert). After a comparison between Brownian ephemerides and more recent precise Moon ephemerides, parameter estimates were performed for interpolation and extrapolation of Moon ranges. The integration procedure allows deeper insight into the time dependent changes of the variable constants and in the mechanical model. The extrapolation procedure is not suited for precise predictions. The results of the test calculation, based on the supposition of supplements which are constant in time, are not suited for predictions with a better precision than 100 to 200 m. The variations resulting from the parameter suppositions have generally a periodic effect on the Moon ranges. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-28110# Societe Nationale Industrielle Aerospatiale, Paris (France).

THE EVOLUTION OF TACTICAL MISSILES SINCE 1945 [L'EVOLUTION DES MISSILES TACTIQUES DE 1945 A NOS JOURS]
Allier 1986 20 p In FRENCH
(SNIAS-861-320-101; ESA-86-97155) Avail: NTIS HC A02/MF A01

The development of tactical missiles in Europe, and particularly in France, is reviewed. The discussion includes target missiles, air-surface missiles, air-air missiles, antitank missiles, antimissile missiles and antiship missiles. It is shown that most of the missiles discussed are adopted by many different nations and several weapon systems are built under licence in several countries. ESA

N86-28111# Societe Nationale Industrielle Aerospatiale, Paris (France).
INNOVATION AND TACTICAL MISSILES [INNOVATION ET MISSILES TACTIQUES]
J. P. Comon 1986 7 p In FRENCH
(SNIAS-861-320-102; ESA-86-97156) Avail: NTIS HC A02/MF A01

Examples of design developments of tactical missiles are given to illustrate the contribution of new ideas to the improvement of military missiles. These developments include placing forward the propulsion section of antitank missiles to improve efficiency by automatically providing a standoff distance; the modification of the Exocet antiship missile to a Mach 2 velocity; an improved guiding system and a main propulsion assured by ramjet engine; and an antimissile missile with a very short reaction time combining rocket engine and aerodynamic forces to provide a high precision guiding system. The design and test facilities required are also discussed. ESA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N86-28112# Fondazione Ugo Bordoni, Rome (Italy).
WAVE PROPAGATION EXPERIMENTS USING THE ECS SATELLITE TELEMETRY BEACON [SPERIMENTAZIONE DI PROPAGAZIONE CON IL BEACON DI TELEMTRIA DEI SATELLITI ECS]
Ermanno Fionda, Paolo Lombardi, Piergiorgio Migliorini, and Salvatore Piazzolla Sep. 1985 20 p In ITALIAN
(FUB-17-1985; ESA-86-97084) Avail: NTIS HC A02/MF A01

An experiment to utilize the 11.45 GHz telemetry beacon and the tracking facilities of the ECS satellite is described. The adaptation of two receiving stations is mentioned. Space diversity and distribution of the rain attenuation were studied. The data acquisition system, based on a HP-1000 computer and the receiving and measuring systems are discussed. The error analysis shows that the attenuation measurement error is 1 dB rms. ESA

N86-28284*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PARKES-CDSCC TELEMETRY ARRAY: EQUIPMENT DESIGN
D. W. Brown, H. W. Cooper, J. W. Armstrong, and S. S. Kent *In its* The Telecommunications and Data Acquisition Report 15 May 1986 26 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09F

N86-28288*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK TRACKING SYSTEM, MARK 4-A, 1986
J. A. Wackley *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09D

N86-28293*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE VENUS BALLOON PROJECT TELEMETRY PROCESSING
J. M. Urech, A. Chamarro, J. L. Morales, and M. A. Urech *In its* The Telecommunications and Data Acquisition Report 15 May 1986 13 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09D

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-28113*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONTROL/STRUCTURES INTERACTION STUDY OF TWO 300 KW DUAL-KEEL SPACE STATION CONCEPTS
John W. Young, Frederick J. Lallman, Paul A. Cooper, and Daniel P. Giesy (PRC Kentron, Inc., Hampton, Va.) May 1986 61 p
(NASA-TM-87679; NAS 1.15:87679) Avail: NTIS HC A04/MF A01 CSCL 22B

The results of an investigation of the influence of structural stiffness of the space station framework on the controllability of two 300 kw class, solar dynamic powered, dual-keel space station designs are presented. The two design concepts differed only in the truss bay dimensions of the structural framework of the stations. Two control studies were made: (1) A study of the interaction of the framework structural response with the reaction control system used for attitude control during an orbital reboost maneuver; and (2) A study of the stability of the space station attitude control system with sensors influenced by the elastic deformations of the station framework. Although both configurations had acceptable control characteristics, the configuration with the larger truss bay dimension and its increased structural stiffness had more attractive characteristics for pointing control of the solar dynamic system during reboost and for attitude control during normal in-orbit operations. Author

N86-28114*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANALYTICAL INVESTIGATION OF THE DYNAMICS OF TETHERED CONSTELLATIONS IN EARTH ORBIT, PHASE 2 Quarterly Report, 22 Dec. 1985 - 21 Mar. 1986
Enrico C. Lorenzini, David A. Arnold, Mario D. Grossi, and Gordon E. Gullahorn Mar. 1986 29 p
(Contract NAS8-36606)
(NASA-CR-178846; NAS 1.26:178846; QR-4) Avail: NTIS HC A03/MF A01 CSCL 22B

The g-tuning maneuvers of a 3-mass, vertical tethered system

are considered. In particular, the case of reaching a zero-g acceleration level on board the middle mass from a non-zero initial condition is analyzed. A control law that provides a satisfactory transient response is derived. The constellation dynamics in the case of the middle mass travelling from one tether tip to the other is also investigated. Instabilities that take place at the end of the maneuver are analyzed and accommodated by devising suitable damping algorithms. M.G.

N86-28115*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATIONS OF TETHERS IN SPACE: A REVIEW OF WORKSHOP RECOMMENDATIONS
Georg vonTiesenhausen, ed. May 1986 24 p
(NASA-TM-86549; NAS 1.15:86549) Avail: NTIS HC A02/MF A01 CSCL 22B

Well-organized and structured efforts of considerable magnitude involving NASA, industry, and academia have explored and defined the engineering and technological requirements of the use of tethers in space and have discovered their broad range of operational and economic benefits. The results of these efforts have produced a family of extremely promising candidate applications. The extensive efforts now in progress are gaining momentum and a series of flight demonstrations are being planned and can be expected to take place in a few years. This report provides an analysis and a review of NASA's second major workshop on Applications of Tethers in Space held in October 15 to 17, 1985, in Venice, Italy. It provides a summary of an up-to-date assessment and recommendations by the NASA Tether Applications in Space Program Planning Group, consisting of representatives of seven NASA Centers and responsible for tether applications program planning implementation as recommended by the workshop panels. Author

N86-28116# Consulenze Generali Roma (Italy).
NUMERICAL EXPERIMENTS ON A CONTROLLED FLEXIBLE STRUCTURE USING DCAF Final Report
F. Graziani and C. Arduini Nov. 1984 264 p
(ESA-CR(P)-2159; ESA-86-96861) Avail: NTIS HC A12/MF A01

The Deficiency Corrective Action Program (DCAP) code was used to simulate analog and digital control of a flexible spacecraft for the case of only in-plane motion, without spinning. For analog control, a simple PD scheme with sensors and actuators on the main rigidbody, with control relying on separation between control bandwidth and the lowest elastic frequency, and fully flexible modal control based on LQG programs are studied. For digital control, a problem for sampled sensor signal (at constant sample interval) digital logic and actuation is formulated by a zero order sample and hold device (at constant sample rate). ESA

N86-28117# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
COMPUTATION OF TETHERED SATELLITE POTENTIAL, CURRENT, AND AMBIENT MAGNETIC FIELD
M. Candidi Aug. 1985 18 p
(IFSI-85-8; ESA-86-97092) Avail: NTIS HC A02/MF A01

A tethered satellite magnetic field, tether current timeline, and induced potential timeline were calculated. The total magnetic field is modulated between 21,000 nT and 48,000 nT: the minimum in the total field is due to the South Atlantic anomaly. In upward deployment of the tethered satellite (for a westward motion of the system) the natural polarity is such that the satellite is positively charged with respect to the ambient plasma (while the Shuttle termination of the tether tends to go negative with respect to the plasma); vice versa for a downward deployment. Tether current is 20 to 70 times above the undisturbed plasma thermal current, i.e., 30 mA for a satellite with a radius of 80 cm, for an applied voltage of 4 kV. ESA

N86-28118# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Lab. des Materiaux.
DESIGN OF BONDED STRUCTURAL JOINTS FOR SPACECRAFT [CALCUL DES LIASONS COLLEES STRUCTURALES DANS LES VEHICULES SPATIAUX]
Jean-Pierre Maigret and Michel Martin 1986 20 p In FRENCH Presented at Colloq. sur les Tendances en Calcul des Struct., Bastia, France, 6-8 Nov. 1985
(SNIAS-861-430-105; ESA-86-97167) Avail: NTIS HC A02/MF A01

It is shown that for designing bonded joints, computer programs must include joint geometry, stress, environment, tolerances, and adhesive characteristics. The results of the experimental evaluation of characterization methods are presented and the most important unsolved problems are indicated. ESA

N86-28119# Swedish Space Corp., Solna.
STUDY ON SOUNDING ROCKET PAYLOAD ALTERNATIVES, WORK PACKAGE 1 Final Report
Rolf Joensson Paris ESA 28 Mar. 1983 24 p
(Contract ESA-4951/81-F-FC(SC))
(M5/1-11-Vol-1; ESA-CR(P)-2154-Vol-1; ESA-86-96856) Avail: NTIS HC A02/MF A01

Nine proposals accepted for flight on Swedish modules in the TEXUS 7/8 campaign are summarized. They concern soldering; floating zone; diffusion; heat conduction; preparation of single crystals of rare earth-magnesium compounds; immiscible alloy systems; retention of a fine precipitate dispersion; formation of metal foam; and precipitation and collision of small crystals during cooling. ESA

N86-28120# Swedish Space Corp., Solna.
STUDY ON SOUNDING ROCKET PAYLOAD ALTERNATIVES, WORK PACKAGE 2 Final Report
Rolf Joensson Paris ESA 28 Mar. 1983 105 p
(Contract ESA-4951/81-F-FC(SC))
(M5/1/11-Vol-2; ESA-CR(P)-2154-Vol-2; ESA-86-96857) Avail: NTIS HC A06/MF A01

A concept for a small multimirror furnace is investigated. Theoretical models for important design parameters, such as maximum sample temperature, heating rate, and crucible temperature distribution are made. Practical tests with a breadboard model verify the theoretical calculations and indicate that the concept is correct. The importance of selecting the proper crucible material is investigated. The crucible must have acceptable thermoshock qualities and also be nonreactive with the sample. The possibility of integrating the furnace into existing Swedish sounding rocket modules is discussed. ESA

N86-28408*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TETHERED SATELLITE SYSTEM
James Sisson *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 37-61 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28409*# Consiglio Nazionale delle Ricerche, Rome (Italy). Programma Spaziale Nazionale.
TETHERED SATELLITE DESIGN
Gianfranco Manarini *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 63-79Vol-1) ?ILLEGAL DATE? (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28878*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CASSINI-TITAN PROBE CONCEPT
G. E. N. Scoon *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 245-260 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-28121*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HALOGEN OCCULTATION EXPERIMENT (HALOE) PERFORMANCE VERIFICATION TEST PROCEDURE
Lemuel E. Mauldin, III Jul. 1986 138 p
(NASA-TM-87748; NAS 1.15:87748) Avail: NTIS HC A07/MF A01 CSCL 14B

The Performance Verification Test Procedure is given for the Halogen Occultation Experiment (HALOE) instrument, which is being developed in house at the Langley Research Center for the Upper Atmosphere Research Satellite (UARS). This procedure is used for comprehensive performance testing of the HALOE instrument which occurs before, during, and after flight environmental tests. The radiometric performance tests include noise, drift, linearity, instantaneous field-of-view, cal wheel gas cell characterization, and self thermal emissions. Pointer/tracker performance tests include sun sensor performance, gimbal performance, control system performance, and boresight alignment. In addition, the instrument is tested functionally in simulated orbit sequences and all command operating modes are exercised. The data analysis required for each test is specified and pass/fail criteria are given where applicable. This test will fully demonstrate the HALOE instrument's ability to achieve science mission requirements. The HALOE instrument is a gas correlation radiometer that measures vertical distribution of eight upper atmospheric constituents: O3, HCl, HF, NO, CH4, H2O, NO2, and CO2. Author

N86-28882# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
AN AEROSOL COLLECTOR PYROLYSER FOR THE CASSINI TITAN PROBE
Guy Israel *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 281-286 Sponsored by SNIAS (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-28122*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 20 KILOHERTZ SPACE STATION POWER SYSTEM
Irving G. Hansen and Fredrick J. Wolff 1986 10 p Proposed for presentation at the 19th Annual Electronics and Aerospace Conference, Washington, D.C., 9 Sep. 1986; sponsored by IEEE
(NASA-TM-88801; E-3140; NAS 1.15:88801) Avail: NTIS HC A02/MF A01 CSCL 10B

The space station represents the next major U.S. commitment in space. The efficient delivery of power to multiple user loads is key to that success. In 1969, NASA Lewis Research Center began a series of studies with component and circuit developments that led to the high frequency, bi-directional, four quadrant resonant driven converter. Additional studies and subsequent developments into the early 1980's have shown how the high frequency ac power system could provide overall advantages to many aerospace power systems. Because of its wide versatility, it also has outstanding advantages for the Space Station Program and its wide range of users. High frequency ac power provides higher efficiency, lower cost, and improved safety. The 20 kHz power system has exceptional flexibility, is inherently user friendly, and is compatible with all types of energy sources - photovoltaic, solar dynamic, rotating machines or nuclear. Lewis has recently completed development under contract a 25 kW, 20 kHz ac power distribution system testbed. The testbed demonstrates flexibility, versatility, and transparency to user technology as well as high efficiency, low mass, and reduced volume. Author

N86-28123*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RAIL ACCELERATORS FOR SPACE TRANSPORTATION: AN EXPERIMENTAL INVESTIGATION
Lynnette M. Zana, William R. Kerslake, and John L. Sturman May 1986 37 p
(NASA-TP-2571; E-2754; NAS 1.60:2571) Avail: NTIS HC A03/MF A01 CSCL 09C

An experimental program was conducted at the Lewis Research Center with the objective of investigating the technical feasibility of rail accelerators for propulsion applications. Single-stage, plasma driven rail accelerators of small (4 by 6 mm) and medium (12.5 by 12.5 mm) bores were tested at peak accelerating currents of 50 to 450 kA. Streak-camera photography was used to provide a qualitative description of plasma armature acceleration. The effects of plasma blowby and varying bore pressure on the behavior of plasma armatures were studied. Author

N86-28124*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURRENT EVALUATION OF THE TRIPROPELLANT CONCEPT
Robert L. Zurawski Jun. 1986 30 p Presented at the AIAA/SAE/ASME/ASEE 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986
(NASA-TP-2602; E-2863; NAS 1.60:2602) Avail: NTIS HC A03/MF A01 CSCL 21I

An analytical study was conducted to determine the specific-impulse advantages of adding metals to conventional liquid-bipropellant systems. These tripropellant systems theoretically offer higher specific impulse and increased propellant density compared with bipropellant systems. Metals considered were Be, Li, and Al. Bipropellant systems were H2/O2, N2H4/N2O4, RP-1/O2, and H2/F2. Thermochemical calculations were performed for sea-level expansion from 6.895-MN/sq. m. (1000-psia) chamber pressure over a wide range of mixture ratios and propellant compositions. Three-dimensional plots characterize the specific impulse of each tripropellant system. Technology issues pertinent to metallized propellant systems are discussed. Author

N86-28125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE VOLTAGE THRESHOLD FOR ARCING FOR SOLAR CELLS IN LEO: FLIGHT AND GROUND TEST RESULTS
Dale C. Ferguson Mar. 1986 22 p Presented at the 24th AIAA Aerospace Sciences Meeting, Reno, Nev., 6-9 Jan. 1986
(NASA-TM-87259; E-2951; NAS 1.15:87259; AIAA-Paper-86-0362) Avail: NTIS HC A02/MF A01 CSCL 10B

Ground and flight results of solar cell arcing in low Earth orbit (LEO) conditions are compared and interpreted. It is shown that an apparent voltage threshold for arcing may be produced by a strong power law dependence of arc rate on voltage, combined with a limited observation time. The change in this apparent threshold with plasma density is a reflection of the density dependence of the arc rate. A nearly linear dependence of arc rate on density is inferred from the data. A real voltage threshold for arcing for 2 by 2 cm solar cells may exist however, independent of plasma density, near -230 V relative to the plasma. Here, arc rates may change by more than an order of magnitude for a change of only 30 V in array potential. For 5.9 by 5.9 solar cells, the voltage dependence of the arc rate is steeper, and the data are insufficient to indicate the existence of an arcing increased by an atomic oxygen plasma, as is found in LEO, and by arcing from the backs of welded-through substrates. Author

N86-28126# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
A STUDY OF SOLID FUEL RAMJET (SOFRAM) POWERED BALLISTIC PROJECTILES FOR LONG RANGES
Ralf Eliasson Jan. 1986 48 p In SWEDISH; ENGLISH summary Sponsored by Swedish Material Administration of the Armed Forces
(FOA-C-20594-D3; ISSN-0347-3694; ESA-86-97035) Avail: NTIS HC A03/MF A01

A quasidynamic trajectory computer program was implemented with a routine for the study of ballistic projectiles powered with Solid Fuel Ramjet (SOFRAM) engines. The routine is described and the results from calculations are discussed. A range of some 70 km is possible with a 155 mm caliber SOFRAM projectile, when initiation occurs the earliest possible after firing and when the motor impulse remains the highest possible up to the maximum functional level. Base pressure is of great importance. ESA

N86-28214# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
LASER-INDUCED FLUORESCENCE IMAGING OF SOLID PROPELLANT FLAMES
T. Edwards, D. P. Weaver, S. Hulsizer (Dayton Univ. Research Inst., Edwards AFB, Calif.), and D. H. Campbell *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 13-20 Previously announced in IAA as A86-19800 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28215# Dayton Univ., Ohio. UDRI Fluid Mechanics.
OPTICAL CONSIDERATIONS IN OBTAINING A STATISTICAL DATA BASE ON PROPELLANT DEFLAGRATION
R. J. Becker and J. L. Laird *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 21-28 (For primary document see N86-28212 19-28)
(Contract F04611-83-K-0023)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28223# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
DRIVING OF AXIAL OSCILLATIONS BY SIMULATED SOLID PROPELLANT FLAMES
S. V. Sankar, J. I. Jagoda, B. R. Daniel, and B. T. Zinn *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 113-121 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0082-84)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28225# Naval Weapons Center, China Lake, Calif.
ANALYSIS OF LONGITUDINAL CHAMBER PRESSURE OSCILLATIONS IN SHUTTLE SRB'S DURING FLIGHT
H. B. Mathes and C. J. Bicker *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 133-138 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28226# Georgia Inst. of Tech., Atlanta.
ENERGY BALANCE ANALYSIS OF VORTEX DRIVEN OSCILLATIONS
G. A. Flandro *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 139-149 (For primary document see N86-28212 19-28)
(Contract F04611-83-C-0003)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28234# Army Research and Development Command, Dover, N.J.
A STUDY OF DIFFUSION IN PROPELLANT GASES USING MOLECULAR DYNAMICS
T. Vladimiroff *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 257-262 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28239# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
FLAME DRIVING OF LONGITUDINAL INSTABILITIES IN DUMP TYPE RAMJET COMBUSTORS
U. G. Hedge, D. Reuter, B. R. Daniel, and B. T. Zinn *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 307-316 Previously announced in IAA as A86-19839 (For primary document see N86-28212 19-28)
(Contract N00014-84-K-0470)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28240# California Inst. of Tech., Pasadena.
NONLINEAR ANALYSIS OF PRESSURE OSCILLATIONS IN RAMJET ENGINES
Vigor Yang and Fred E. C. Culick *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 317-329 (For primary document see N86-28212 19-28)
(Contract N00014-84-K-0434)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28241# Flow Research, Inc., Kent, Wash.
LARGE EDDY SIMULATIONS OF FLOW IN A RAMJET COMBUSTOR
Wen-Huei Jou and Suresh Menon *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 331-339 (For primary document see N86-28212 19-28)
(Contract N00014-84-C-0359)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28242# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
ACOUSTIC-VORTEX INTERACTIONS IN AN IDEALIZED RAMJET COMBUSTOR
K. Kailasanath, J. Gardner, J. Boris, and E. Oran *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 341-350 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28243# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
FLOW VISUALIZATION STUDIES OF A SOLID FUEL RAMJET COMBUSTOR USING A NEW MATERIAL-POLYAPHRONS
J. A. Schetz, F. Sebba, and R. H. Thomas *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 351-359 (For primary document see N86-28212 19-28)
(Contract F33615-84-C-2468)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28244# Atlantic Research Corp., Alexandria, Va.
PREDICTION OF BORON DUST CLOUD FLAME SPEEDS
Merrill K. King *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 361-376 (For primary document see N86-28212 19-28)
(Contract F49260-81-C-0035)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28252# Pratt and Whitney Aircraft, West Palm Beach, Fla. Engineering Div.
PERFORMANCE COMPARISON OF THE CURRENT SSME AND A NEW MAIN INJECTOR-MAIN COMBUSTION CHAMBER CONFIGURATION USING THE JANNAF METHODOLOGY
R. G. Carroll, D. R. Connell, and C. D. Limerick *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 453-462 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28254*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
SSME FUEL PREBURNER PHASE 1/PHASE 2+ COMPARISON
R. J. Jensen, P. Y. Liang, and S. M. Pinkowski *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985

p 473-476 (For primary document see N86-28212 19-28)
(Contract NAS8-27980)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-28127 Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
COMPOUNDS, BETWEEN WISHES AND REALITY [VERBUND-WERKSTOFFE ZWISCHEN WUNSCH UND WIRKLICHKEIT]
Gerhard Ondracek Nov. 1985 8 p Reprint from Umschau 7/85, Broenner, Frankfurt am Main, 1985 In GERMAN
(KfK-4003; ESA-86-96914) Avail: Issuing Activity

Compound materials and their applications are reviewed. The three main groups of materials are presented: metallic materials, ceramics (nonmetallic inorganic materials), and nonmetallic (nonmetallic-organic) materials. It is explained in what sense compounds have to be technologically and economically feasible. The research and development status of compound materials is discussed. Utilization domains of compound materials are given.
ESA

N86-28128*# Salk Institute for Biological Studies, San Diego, Calif.
OLIGOGLYCERIC ACID SYNTHESIS BY AUTOCONDENSATION OF GLYCEROYL THIOESTER
Arthur L. Weber Aug. 1986 22 p
(Grant NsG-7627)
(NASA-CR-177130; NAS 1.26:177130) Avail: NTIS HC A02/MF A01 CSCL 07A

The autocondensation of the glyceroyl thioester, S-glyceroyl-ethane-thiol, yielded oliogiyceric acid. The rates of autocondensation and hydrolysis of the thioester increased from pH 6.5 to pH 7.5 in 2,6-lutidine and imidazole buffers. Autocondensation and hydrolysis were much more rapid in imidazole buffers as compared to 2,6-lutidine and phosphate buffers. The efficiency of ester bond synthesis was about 20% for 40 mM S-glyceroyl-ethane-thiol in 2,6-lutidine and imidazole buffers near neutral pH. The size and yield of the oliogiyceric acid products increased when the concentration of the thioester was increased. The relationship of these results to prebiotic polymer synthesis is discussed. Author

N86-28869# Paris-Val de Marne Univ., Creteil (France). Lab. de Physicochimie de l'Environnement.
ORGANIC CHEMISTRY ON TITAN: LABORATORY SIMULATIONS AND SPECULATION [CHIMIE ORGANIQUE DANS TITAN: EXPERIENCES DE SIMULATION EN LABORATOIRE ET SPECULATIONS]
F. Raulin *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 161-173 In FRENCH (For primary document see N86-28849 19-88)
(Contract CNES-85-1251)
Avail: NTIS HC A14/MF A01

24 COMPOSITE MATERIALS

Includes laminates.

N86-28129*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF ANNEALING HISTORY ON FREE VOLUME IN THERMOPLASTICS
Jag J. Singh and Terry L. St.Clair Jul. 1986 11 p
(NASA-TM-87734; NAS 1.15:87734) Avail: NTIS HC A02/MF A01 CSCL 11D

Two different types of thermoplastic glassy polymers have been investigated for the effects of thermal annealing on their free volumes. It has been observed that free volumes in glassy polymers decrease asymptotically to a steady level after about four thermal anneals lasting for 24 hours at a temperature about 50 C below their glass transition temperatures. These results indicate that composites incorporating properly annealed thermoplastic matrices may not experience any additional internal stresses due to subsequent thermal excursions experienced while in service.
Author

N86-28130*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
SUBLAMINATE ANALYSIS OF INTERLAMINAR FRACTURE IN COMPOSITES Final Technical Report
Erian A. Armanios and Lawrence W. Rehfield 1986 89 p
(Grant NAS1-558)
(NASA-CR-177228; NAS 1.26:177228) Avail: NTIS HC A05/MF A01 CSCL 11D

A simple analysis method based upon a transverse shear deformation theory and a sublaminate approach is utilized to analyze a mixed-mode edge delamination specimen. The analysis provides closed form expressions for the interlaminar shear stresses ahead of the crack, the total energy release rate, and the energy release rate components. The parameters controlling the behavior are identified. The effect of specimen stacking sequence and delamination interface on the strain energy release rate components is investigated. Results are compared with a finite element simulation for reference. The simple nature of the method makes it suitable for preliminary design analyses which require a large number of configurations to be evaluated quickly and economically. Author

N86-28131* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIGHT WEIGHT FIRE RESISTANT GRAPHITE COMPOSITES Patent
Demetrius A. Kourtides, John A. Parker, and Ming-Ta S. Hsu Issued 1 Jul. 1986 12 p Filed 28 Feb. 1985 Supersedes N85-28976 (23 - 18, p 3068)
(NASA-Class-ARC-11615-1SB; US-Patent-4,598,007; US-Patent-Appl-SN-706682; US-Patent-Class-428-116; US-Patent-Class-428-408; US-Patent-Class-428-921; US-Patent-Class-526-265) Avail: US Patent and Trademark Office CSCL 11D

Composite structures with a honeycomb core and characterized by lightweight and excellent fire resistance are provided. These sandwich structures employ facesheets made up of bismaleimide-vinyl styrylpyridine copolymers with fiber reinforcement such as carbon fiber reinforcement. In preferred embodiments the facesheets are over layered with a decorative film. The properties of these composites make them attractive materials of construction aircraft and spacecraft. NASA

N86-28132# General Dynamics Corp., Fort Worth, Tex.
CUMULATIVE DAMAGE MODEL FOR ADVANCED COMPOSITE MATERIALS Final Report, Oct. 1983 - Jan. 1985
H. R. Miller, K. L. Reifsnider, W. W. Stinchcomb, D. A. Ulman, and R. D. Bruner Jun. 1985 168 p
(Contract F33615-81-C-5049)
(AD-A165688; AFWAL-TR-85-4069) Avail: NTIS HC A08/MF A01 CSCL 11/4

This report details the model verification activity of Phase 3 of this program and summarizes the modeling effort conducted over the entire program duration. In the Phase 3 effort, the model was used to predict the specimen response using four previously unstudied parameter variations. The variations consisted of introduction of a different specimen width than that used in Phase 1 and 2, a new stacking sequence, new loading conditions applied to previously studied stacking sequence, and a different material system (T300/V378A as opposed to AS/3501 used throughout Phases 1 and 2). In each case the model predictions were obtained prior to the specimen testing; in fact, the model was used to determine the load conditions used in the test program. In all

cases, predicted lifetimes were within the same decade-- indicating good agreement between the theory and experiment for fatigue analysis. Also discussed are the methodologies associated with applying the model in tension-tension, tension-compression, compression-compression, and mixed block loading situations. Sensitivity of the model to various parameters in these loading conditions is demonstrated. GRA

N86-28133# Construcciones Aeronauticas S.A., Madrid (Spain).
CHEMICAL CONTROL FOR AIRBUS COMPOSITES. HPLC STANDARDIZATION
J. Sanchez and E. Garate 20 Dec. 1984 141 p
(I-104/84; ESA-86-97060) Avail: NTIS HC A07/MF A01

Liquid chromatography with a UV detector to assess resins used in the Airbus was tested on two resins. Results show that the chromatographic method permits an adequate separation of the different components of both resins, though the fact of having to perform a gradient limits the integration accuracy of the different peaks and therefore supposes a limitation of the method. None of the two wavelengths used (220 and 230 nm) seems to have any influence on the accuracy of the results obtained. ESA

N86-28134# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Lab. Materiaux et Procedes.
COMPOSITES REVIEW [DOSSIER COMPOSITES]
Alain Hordonneau 11 Jan. 1986 19 p In FRENCH
(SNIAS-861-430-108; ESA-86-97170) Avail: NTIS HC A02/MF A01

The properties and applications of composite materials are reviewed. Glass, carbon, Kevlar, ceramic, whisker, and metal fibers, and polyester, epoxy, polyimide, Peek, carbon, ceramic, and metal matrices are discussed. The quantitative distribution of high technology fibers in various applications is given. The role of aerospace industry in the development and promotion of composite utilization is discussed. Consumption trends indicate a rapid development of the composite market. ESA

N86-28135# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
WEAR-RESISTANT MATERIALS BASED ON BORON CARBIDE Thesis - Karlsruhe Univ., West Germany
Dietrich Lange Dec. 1985 204 p In GERMAN; ENGLISH summary
(KfK-4009; ISSN-0303-4003; ESA-86-96915) Avail: NTIS HC A10/MF A01

Characteristics, wear behavior, and applications of boron carbide are discussed. The extraordinary property of boron carbide is its high hardness even at high temperatures; it is considerably less expensive than the harder materials diamond and cubic boron nitride. The disadvantage of boron carbide is its brittleness. Applications in wear resistant materials therefore require an increased strength and a reduced brittleness. Because of the reactivity of boron carbide, only the formation of numerous phase and grain boundaries is a successful possibility. Investigations of phase relations show that there is no coexistence between boron carbide and binder materials such as Fe, Co, or Ni. Silicon wets boron carbide very well. Transformation strengthening of boron carbide seems to be impossible. Boron carbide is coexistant with several refractory materials and borides of the transition metals; a special method of hot pressing was developed for densification of these materials. Toughness and strength of tools containing boron carbide is sufficient for cutting applications. Materials based on boron carbide exhibit an outstanding resistance against abrasive wear. ESA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-28136*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
A STUDY OF KAPTON DEGRADATION UNDER SIMULATED SHUTTLE ENVIRONMENT Final Report, 1 May 1983 - 30 Apr. 1986
T. G. Eck and R. W. Hoffman Jul. 1986 9 p
(Grant NAG3-426)
(NASA-CR-176850; NAS 1.26:176850) Avail: NTIS HC A02/MF A01 CSCL 07D

A system was developed which employs a source of low energy oxygen ion to simulate the shuttle low Earth orbit environment. This source, together with diagnostic tools including surface analysis ans mass spectroscopic capability, was used to measure the dependence of ion energy of the oxygen induced CO signals from pyrolytic graphite and Kapton. For graphite the CO signal was examined at energies ranging form 4.5 to 465 eV and for Kapton from 4.5 to 188 eV. While the relative quantum yields inferred from the data are reasonably precise, there are large uncertainties in the absolute yields because of the assumptions necessary to covert the measured signal strengths to quantum yields. These assumptions are discussed in detail. B.G.

N86-28137*# National Aeronautics and Space Administration, Washington, D.C.
CATALYSTS FOR THE DECOMPOSITION OF HYDRAZINE AND ITS DERIVATIVES AND A METHOD FOR ITS PRODUCTION
R. Sasse Jun. 1986 8 p Transl. into ENGLISH of West German Patent no. 1916247 (20 Nov. 1970) p 1-7 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88462; NAS 1.15:88462) Avail: NTIS HC A02/MF A01 CSCL 07D

Catalysts of various types are used to decompose hydrazine and its derivatives. One type of catalyst is made as follows: the aluminum is dissolved out of an alloy of cobalt or nickel/aluminum so that a structure is produced that is chemically active for the monergol and that has a large active surface. The objective was to avoid difficulties and to create a catalyst that not only has a short start time but that can also be manufactured easily and relatively inexpensively. The solution to this task is to coat the base structure of the catalyst with oxides of copper, cobalt and cerium or oxides of copper, cobalt and cerite earth. Author

N86-28138*# National Aeronautics and Space Administration, Washington, D.C.
CATALYSTS FOR THE DECOMPOSITION OF HYDRAZINE, HYDRAZINE DERIVATIVES AND MIXTURES OF BOTH
R. Sasse Jun. 1986 7 p Transl. into ENGLISH of West German Patent no. 2036958 (27 Jan. 1972) p 1-6 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88463; NAS 1.15:88463) Avail: NTIS HC A02/MF A01 CSCL 07D

This invention concerns a catalyst designed for the decomposition of hydrazine, hydrazine derivatives and mixtures of the two. The objective is to develop a catalyst of the type described that is cheap and easy to produce and is also characterized by extremely short response times. Author

N86-28139*# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engrg.
THE BEHAVIOR OF FUEL-LEAN PREMIXED FLAMES IN A STANDARD FLAMMABILITY LIMIT TUBE UNDER CONTROLLED GRAVITY CONDITIONS Final Report, Jan. - Dec.

1985
Brian L. Wherley and Roger A. Strehlow Jul. 1986 143 p
(Contract NCC3-35)
(NASA-CR-177132; NAS 1.26:177132; AAE-86-3;
UILU-ENG-86-0503) Avail: NTIS HC A07/MF A01 CSCL 21B

Fuel-lean flames in methane-air mixtures from 4.90 to 6.20 volume percent fuel and propane-air mixtures from 1.90 to 3.00 volume percent fuel were studied in the vicinity of the limit for a variety of gravity conditions. The limits were determined and the behavior of the flames studied for one g upward, one g downward, and zero g propagation. Photographic records of all flammability tube firings were obtained. The structure and behavior of these flames were detailed including the variations of the curvature of the flame front, the skirt length, and the occurrence of cellular instabilities with varying gravity conditions. The effect of ignition was also discussed. A survey of flame speeds as a function of mixture strength was made over a range of lean mixture compositions for each of the fuels studied. The results were presented graphically with those obtained by other researchers. The flame speed for constant fractional gravity loadings were plotted as a function of gravity loadings from 0.0 up to 2.0 g's against flame speeds extracted from the transient gravity flame histories for corresponding gravity loadings. The effects of varying gravity conditions on the extinguishment process for upward and downward propagating flames were investigated. Author

N86-28140# Evans (Charles) and Associates, San Mateo, Calif.
DEVELOPMENT AND APPLICATION OF SIMS (SECONDARY ION MASS SPECTROMETRY) CHARACTERIZATION TECHNIQUES FOR THE STUDY OF IMPURITIES AND IMPURITY MOTION IN HgCd) Te AND CdTe Final Report, 1 Nov. 1983 - 30 Sep. 1985
Oct. 1985 77 p
(Contract MDA903-82-C-0427; ARPA Order 4606)
(AD-A163047) Avail: NTIS HC A05/MF A01 CSCL 07/4

The tasks in the statement of work for this contract were to develop quantitative methods of secondary ion mass spectrometry (SIMS) analysis and to study the incorporation and redistribution of impurities in (HgCd)Te and CdTe. The second task included investigation of MeV ion implantation into (HgCd)Te and development of an image processing techniques for a quantitative investigation of laterally distributed impurities. The mechanisms and protocols developed were applied to various kinds of (HgCd) Te and its homologs in the characterization of a variety of dopants and impurities of interest to DARPA and its subcontractors. These applications elucidated the mechanism of boron incorporation during the LEC growth of CdTe. GRA

N86-28141# Wisconsin Univ., Madison.
CHARACTERIZATION OF SPUTTER DEPOSITED Al-NITRIDE AND Al-OXIDE BY X-RAY PHOTOELECTRON LOSS SPECTROSCOPY
Charlene J. G. Kubiak, Carolyn R. Aita, Ngoc C. Tran, and Tery L. Barr 1986 10 p
(Contract DAAG29-84-K-0126)
(AD-A165737; ARO-21334.5-MS) Avail: NTIS HC A02/MF A01 CSCL 07/4

The results of an X-ray photoelectron loss spectroscopy (XPLS) study of several wide band gap aluminum compounds are presented here. XPLS is a new application of X-ray photoelectron spectroscopy involving the determination of the energy separation, Delta E, between a particular core photoelectron peak and its principal loss peak. The materials investigated here are sputter deposited thin film Al-nitride and oxide, and bulk single crystal alpha-alumina. It is not possible to distinguish between these materials on the basis of the chemical shift in the binding energy of the Al2p and Al2s photoelectrons (Siegbahn shift). The results show that XPLS can be used to distinguish between these materials. Delta E in Al-oxides and nitride differs by several eV and is independent of sample charging. Comparison with Delta E calculated using a free electron gas model is made and related to the plasmon nature of Delta E. GRA

N86-28142# Princeton Univ., N. J.
THE DETERMINATION OF INTERFACIAL TENSION BY VIDEO IMAGE PROCESSING OF PENDANT FLUID DROPS
S. H. Anastasiadis, J. K. Chen, J. T. Koberstein, A. F. Siegel, and J. E. Sohn 7 Mar. 1986 28 p
(Contract DAAG29-85-K-0245)
(AD-A165745; ARO-22886.1-MS) Avail: NTIS HC A03/MF A01 CSCL 07/4

A novel method for the analysis of interfacial tension from the shape of pendant fluid drops is presented. The experimental apparatus employs digital video image processing techniques to record drop images and to segment the fluid drop profile. An associated drop profile shape analysis algorithm is developed based upon robust shape comparison methods that utilize repeated median concepts. The complete algorithm is designed specifically to be executable on a microcomputer. The performance of the algorithm is illustrated for simulated pendant fluid drop profiles and pendant drops of glycerin. In the latter case, the experimental precision in the resultant surface tension is found to be of the order of 0.5%. GRA

N86-28143# Ministry of Defence, London (England). Directorate of Quality Assurance/Technical Support.
SOME APPLICATIONS OF FAST ATOM BOMBARDMENT MASS SPECTROMETRY
J. Hodson and A. J. Pidduck Aug. 1985 26 p
(AD-A165757; MATERIALS-TP-905; DRIC-BR-98163) Avail: NTIS HC A03/MF A01 CSCL 07/1

The fast bombardment (FAB) ionization source for mass spectrometry (MS) is introduced, and the advantages over other ionization techniques are discussed. Experimental factors are fully described. In initial work, FABMS is applied to the direct analysis of lubricant additives, thermally labile or involatile organic compounds such as macromolecules and ionic dyestuffs, and inorganic compounds. Applications published in the literature are reviewed. Attention is drawn to the high specificity of FABMS for surfactant species since these are often difficult to analyze by other methods. GRA

N86-28144# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDIES OF MOLECULAR MONOLAYERS AT AIR-LIQUID INTERFACES BY SECOND HARMONIC GENERATION: QUESTION OF ORIENTATIONAL PHASE TRANSITION
T. Rasing, Y. R. Shen, M. W. Kim, S. Grubb, and J. Bock Jun. 1985 6 p Presented at the 7th International Conference on Laser Spectroscopy, Maui, Hawaii, 24 Jun. 1985 Prepared in cooperation with Exxon Research and Engineering Co., Annandale, N. J.
(Contract DE-AC03-76SF-00098)
(DE86-002871; LBL-20067; CONF-850605-8) Avail: NTIS HC A02/MF A01

Insoluble molecular monolayers at gas-liquid interfaces provide an insight to the understanding of surfactants, wetting, microemulsions and membrane structures and offer a possibility to study the rich world of 2-dimensional phase transitions. In the interpretation of the observed properties of these systems various assumptions about the molecular orientation are often made, but so far few clear experimental data exist. In this paper we will show how optical second harmonic generation (SHG) can be used to measure the molecular orientation of monolayers of surfactant molecules at water-air interfaces. By simultaneously measuring the surface pressure versus surface molecular area we can show for the first time that the observed liquid condensed-liquid expanded transition is an orientational phase transition. DOE

N86-28145# California Univ., Berkeley. Dept. of Physics.
SECOND-HARMONIC GENERATION FROM SUB-MONOLAYER MOLECULAR ADSORBATES USING A c-w DIODE LASER: MAUI SURFACE EXPERIMENT
G. T. Boyd, Y. R. Shen, and T. W. Hansch Jun. 1985 4 p Presented at the 7th International Conference on Laser Spectroscopy, Maui, Hawaii, 24 Jun. 1985 Prepared in cooperation with California Univ., Berkeley, Lawrence Berkeley Lab. and Stanford

Univ.
(Contract DE-AC03-76SF-00098)
(DE86-002885; LBL-20068; CONF-850605-7) Avail: NTIS HC A02/MF A01

Optical second-harmonic generation (SHG) can be an extremely sensitive tool for surface studies. The technique is capable of probing adsorbed molecules at various interfaces. It is based on the idea that SHG is forbidden in a medium with inversion symmetry, but necessarily allowed at a surface. To see such a surface nonlinear optical effect, high laser intensity is often needed. Thus, in the experiments reported so far, pulsed lasers were used exclusively. From the consideration for practical applications, however, the technique would look much more attractive if the bulky pulsed laser can be replaced by a simple inexpensive c-w diode laser. This paper describes the first demonstration of surface SHG with a c-w laser. DOE

N86-28146# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemical and Environmental Engineering.
KINETIC MEASUREMENTS ON ELEMENTARY FOSSIL FUEL COMBUSTION REACTIONS OVER WIDE TEMPERATURE RANGES Progress Report, 1 Dec. 1984 - 30 Nov. 1985
A. Fontijn and K. Mahmud Dec. 1985 14 p
(Contract DE-FG02-84ER-13224)
(DE86-005502; DOE/ER-13224/2) Avail: NTIS HC A02/MF A01

The use of an HTP (high-temperature photochemistry) facility for experimental measurements on the O + C2H4 reaction is described. Rate coefficient measurements have been obtained from 295 to 1430 K and an extension to higher temperatures is in progress. No previous measurements in the 1050 to 1430 K temperature regime exist. Our data show excellent agreement with earlier measurements over the 295 to 1050 K regime, but suggest deviations from extrapolated expressions based on data from T < 1050 K and T > 1600 K measurements. DOE

N86-28147# SRI International Corp., Menlo Park, Calif.
SEMICONDUCTOR ELECTROCHEMISTRY APPROACH TO THE STUDY OF OXIDE FILMS ON NICKEL AND ZINC Final Report
M. J. Madou, S. Wing, and M. C. H. McKubre Sep. 1985 44 p
(Contract DE-AC03-76SF-00098)
(DE86-005844; LBL-20305) Avail: NTIS HC A03/MF A01

On nickel electrodes, we discovered the mechanisms that explain lithium and cobalt ion contribution to improved nickel electrode performance, and the cobalt might be more effective in the plate from solution rather than in the active material beforehand. The reported capacity improvement can only be confirmed on unrealistically thin battery plates. Fluoride has a negative effect on nickel electrodes (greatly reduces oxygen overpotential), and it offsets the positive effect of lithium. The negative effect of zincate on the oxygen evolution can be offset by LiOH, and the positive effect of cobalt on nickel electrodes is similar to that of lithium. For a beneficial effect, the ions should be small (about 0.6 A), preferably nonelectroactive, and able to act as acceptors in the NiO lattice, and they should poison the oxygen evolution on nickel. PbO is a potentially beneficial additive for the nickel electrode. Mg has a surface catalytic effect to decrease the oxygen overpotential, which reduces the nickel electrode charge capacity. On zinc electrodes, Fe decreases the hydrogen overpotential and should be avoided. Fluoride reduces the charge-discharge current peaks by over a factor of ten. Zincate will always be present when zinc is used, reduces the hydrogen overpotential at low concentrations and tends to increase it at high concentrations. PbO has a beneficial effect on the zinc electrode as well, and seems like a good additive for Ni/Zn batteries. Photocurrent experiments on the passive zinc electrode reveal the presence of an n-type semiconductor (possibly two separate phases), and impedance measurements indicate the higher resistance of the passive film on zinc in a fluoride-containing alkaline solution, compared to the alkaline solution without the fluoride. DOE

N86-28148# Pittsburgh Univ., Pa. Dept. of Chemical and Petroleum Engineering.
CHEMICAL TRAPPING AND IR STUDIES CO/H SURFACE SPECIES Quarterly Report, Sep. - Nov. 1985
D. G. Blackmond and I. Wender Dec. 1985 6 p
(Contract DE-FG22-85PC-80526)
(DE86-004847; DOE/PC-80526/T1; QR-1) Avail: NTIS HC A02/MF A01

CO hydrogenation reactions over supported metals can produce a wide spectrum of hydrocarbon and oxygenated compounds depending to a large extent on the type of metal used. Elucidating the nature of the intermediate species formed on metal surfaces may provide the key to understanding the pathways through which these reactions proceed on different metals. Research is proposed to investigate intermediate species formed during CO hydrogenation reactions on silica-supported Pd, Rh, Ru, and Ni catalysts. A novel chemical trapping technique will be used to identify adsorbed intermediates. Coupled with in-situ IR spectroscopic investigations of adsorption and reaction on the catalysts, these trapping studies should provide a framework for understanding differences in CO hydrogenation reaction pathways over different metals. In addition, chemical trapping studies using selected transition metal complexes of known structure will be carried out to help evaluate the techniques as well as to help establish relationships between homogeneous and heterogeneous catalytic reactions of CO and H. During the first quarter of the project, a research team has been assembled, the high pressure reaction system has been designed and reaction parts and supplies have been ordered. Preliminary IR investigations of CO adsorption on Rh/Al O have been performed. Preparation methods of model transition metal complexes has been investigated. DOE

N86-28149# New Mexico Univ., Albuquerque. Dept. of Chemistry.
RESONANCE RAMAN INVESTIGATION OF TRANSIENT PHOTO-INDUCED LIGATION CHANGES IN NICKEL PORPHYRINS
E. W. Findsen, J. A. Shelnutt, J. M. Friedman, and M. R. Ondrias 1985 20 p Presented at the International Conference on Exited States and Dynamics of Porphyrins, Little Rock, Ark., 17 Nov. 1985 Prepared in cooperation with Sandia National Labs., Albuquerque, N.M. and Bell Telephone Labs., Murray Hill, N.J.
(Contract DE-AC04-76DP-00789)
(DE86-005433; SAND-85-2842C; CONF-8511135-2) Avail: NTIS HC A02/MF A01

The first picosecond and nanosecond time-resolved Raman spectra of photo-excited metalloporphyrins in coordinating and noncoordinating solvents are presented. Our data demonstrate that resonance Raman spectra can be obtained from transient nickel porphyrin species and confirm the existence of photo-induced ligation changes in nickel proto and octaethyl porphyrin species on a sub-nanosecond timescale. DOE

N86-28150# Massachusetts Univ., Amherst. Dept. of Chemical Engineering.
MULTIVARIABLE AND DISTRIBUTED CONTROL OF NONLINEAR CHEMICAL PROCESSES USING ADAPTIVE METHODS Progress Report, 1 Jan. 1985 - 31 Dec. 1988
B. E. Ydstie Nov. 1985 38 p
(Contract DE-FG02-85ER-13318)
(DE86-005505; DOE/ER-13318/1) Avail: NTIS HC A03/MF A01

This report summarizes work aimed towards the development of multivariable adaptive controllers. The emphasis in this research has been placed on robustness issues. The research has involved theoretical development of new control strategies as well as the testing of the algorithms in simulation studies of a variety of distillation columns. The main result to date is a global stability result for the Extended Horizon Controller (EHC) in the multivariable, deterministic case. This result is valid for linear, open loop stable systems only and we are currently in the process of extending it to cover the nonlinear compensation technique described in the main proposal, and open loop unstable systems. Current theoretical studies center around the development of automatic tuning strategies. Preliminary simulation studies for single-input single-output systems show great promise. Our algorithms have been modified so that they use the incremental rather than the standard backward shift operators. This offers

substantial numerical advantages. A novel technique for weighing coefficient selection is also being investigated. DOE

N86-28151# Lawrence Livermore National Lab., Calif.
RAMAN SCATTERING METHOD FOR HIGH PRECISION COMPARATIVE MEASUREMENTS OF THE OXYGEN CONCENTRATION IN AIR
P. P. Tans and D. A. Lashof May 1985 115 p
(Contract DE-AC03-76SF-00098)
(DE86-005872; LBL-19977) Avail: NTIS HC A06/MF A01

We describe a method designed to determine relative concentrations of oxygen in air to a few parts per million. The method is based on the comparison of Raman scattering intensities from air in two cells, both of which are placed inside the cavity of an Ar ion laser. The scattered light is channeled through fiber optic light guides into the detectors which consist of dielectric interference filters and photomultiplier tubes. The systematic errors effecting the long-term stability of the intensity comparison are analyzed and our efforts to overcome these errors are described. DOE

N86-28152# Texas Southern Univ., Houston. Dept. of Chemistry.
STUDY OF SOME TRANSITION METAL COMPLEXES AS PROCESS CATALYSTS Quarterly Report, Sep. 1 - 31 Nov. 1985
B. L. Wilson 1985 21 p
(Contract DE-FG22-84PC-70753)
(DE86-005975; DOE/PC-70753/T5) Avail: NTIS HC A02/MF A01

The main objectives of this project are: (1) preparation and characterization of transition metal complexes with nitrogen, oxygen, and sulfur donor ligands, expecially the poly(pyrazolyl) borate ligands; (2) preparation of bimetallic complexes of molybdenum and other metals such as nickel, cobalt, and iron; (3) determination of the ability of the above complexes to catalytically reduce polycyclic aromatic or hererocyclic compounds; (4) evaluation of these complexes as coal liquefaction catalysts; (5) evaluation of these complexes as desulfurization and denitrogenation catalysts; and (6) training of students in transition metal complex preparation and characterization and in the evaluation of metal complexes as process catalysts. Potassium dihydrobis (pyrazolyl)borate was prepared and reacted with cobalt chloride and zirconium halides to produce cobalt and zirconium complexes. The structures and physical properties of the two ligands, potassium dihydrobis(pyrazolyl)borate and potassium hydrobis(pyrazolyl) borate were investigated. Titanium and zirconium complexes are being characterized. The 300 ml autoclave reactor was tested. Three direct coal liquefaction runs were made on Illinois No. 6 River King coal. A typical loading consisted of 35.7 g of coal that had been ground to pass 60 mesh, 70.0 g of SRC II, a distillate cut, and 2000 to 16,000 ppM by weight of metal on dry/ashless coal. Results are presented for the catalytic and noncatalytic liquefaction runs. DOE

N86-28153# A/G Technology Corp., Needham, Mass.
RESEARCH INTO AN ASYMMETRIC MEMBRANE HOLLOW FIBER DEVICE FOR OXYGEN ENRICHED AIR PRODUCTION, PHASE 2 Final Report
A. Z. Gollan and M. H. Kleper Dec. 1985 74 p
(Contract DE-AC07-83ID-12429)
(DE86-006429; DOE/ID-12429/1) Avail: NTIS HC A04/MF A01

Oxygen enriched air (OEA) combustion is a major potential energy conservation measure for American Industry. Enrichment of oxygen content in air to the range of 30% to 35% during combustion benefits energy conservation in two ways. First, it leads to higher flame temperatures which in turn result in higher heat transfer rates with a concomitant reduction in process time requirements. Second, the parasitic nitrogen volume to be heated and subsequently vented at elevated temperatures is lowered. Implementation of oxygen enriched air process modifications in the combustion area will require an economical method of increasing the oxygen concentration in the intake air. Membrane processes are characteristically simple, continuous in operation and potentially highly economical to operate. Due to their modular nature, membrane systems can meet the needs of both the small and the large scale user of oxygen enriched air. In this program a semi-permeable polymeric membrane system which overcomes the limitations of prior membrane technology has been developed for oxygen enrichment. In Phase 1 of this program, laboratory-scale hollow fiber membrane cartridges were developed and an economic analysis model was formulated. In this second phase of the program the hollow fiber membranes were optimized and full-scale cartridges capable of producing about 2 SCFM of 35% oxygen (25 C, compression ratio of 5, 25% conversion) have been fabricated. Actual performance data have been used to update the capital and operating costs model. This report presents the objectives and results of the second phase of this program, including the updated economic analysis. DOE

N86-28154# Massachusetts Univ., Boston. Dept. of Chemistry.
INVESTIGATION OF THE STRUCTURE OF PHOTOSYNTHETIC REACTION CENTERS Progress Report, 1 Jun. 1985 - 31 Jan. 1986
H. vanWilligen Jan. 1986 7 p
(Contract DE-FG02-84ER-13242)
(DE86-006508; DOE/ER-13242/2) Avail: NTIS HC A02/MF A01

Research performed during the period covered by this report addresses the effect of dimerization on the photo-excited triplet state characteristics of a number of porphyrins and metalloporphyrins, the determination of the structure of a tetraphenylporphyrin (TPP) dimer with the aid of ENDOR measurements, and the photooxidation of porphyrin monomers and dimers. DOE

N86-28155# National Bureau of Standards, Gaithersburg, Md. Polymer Science and Standards Div.
POLYMERS: TECHNICAL ACTIVITIES 1985 Annual Report, 1 Oct. 1984 - 30 Sep. 1985
L. E. Smith and B. M. Fanconi Nov. 1985 104 p
(PB86-165024) Avail: NTIS HC A06/MF A01 CSCL 07D

Technical activities of the Polymers Division for FY-85 are reviewed. Included are descriptions of the 6 tasks of the division, project reports, publications, and other technical activities. GRA

N86-28156# National Marine Fisheries Service, Seattle, Wash.
STANDARD ANALYTICAL PROCEDURES OF THE NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) NATIONAL ANALYTICAL FACILITY, 1985-1986: EXTRACTABLE TOXIC ORGANIC COMPOUNDS, SECOND EDITION
W. D. MacLeod, D. W. Brown, A. J. Friedman, D. G. Burrows, and O. Maynes Oct. 1985 113 p refs
(PB86-147873; NOAA-TM-NMFS-F/NWC-92) Avail: NTIS HC A06/MF A01 CSCL 07D

Numerous recent studies demonstrate associations between organic chemical contamination of the aquatic environment and impacts on environmental health and, potentially, on human health. If the results of the one study are compared with those of another, uniform analytical methods for the chemicals will be required. To meet this need, NOAA's National Analytical Facility (NAF) prepared this Technical Memorandum as a methods manual for extractable organic chemicals in marine sediments and tissues. It applies specifically to organic analytes selected for documentation by NOAA's National Statue and Trends (S&T) Program. GRA

N86-28157# Ohio State Univ., Columbus. Research Foundation.
LIMITATIONS ON THE EFFICIENCY OF THE SOLAR PHOTOREDUCTION OF CARBON Final Report, Jun. 1982 - May 1985
R. T. Ross Mar. 1986 30 p
(Contract GRI-5082-260-0642)
(PB86-179074; GRI-86/0035) Avail: NTIS HC A03/MF A01 CSCL 07D

The purpose of the project was to clarify the thermodynamic and kinetic limits on the efficiency of solar photochemistry in general, and the solar photoeducation of carbon in particular. A thought experiment was devised which provides a nonmathematical proof of the generality of the Carnot limitation on the efficiency of converting light energy into work. Proof was

obtained that a simple hybrid solar energy converter can have both very high theoretical efficiency (66%) and properties which are compatible with construction of a practical device. This kind of converter combines the electron-transfer aspect of photoelectrical and photochemical cells with the high-temperature aspect of thermal solar conversion. Losses due to the finite width of the electronic spectral bands of photochemical systems were found to be approximately proportional to the square of this width and to cause a significant loss in achievable conversion efficiency. Bilinear analysis of fluorescence from photosynthetic systems permitted determination of the fluorescence spectra of photosystems I and II. GRA

N86-28158# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
STOICHIOMETRIC CO REDUCTION BY SUPPORTED METAL CARBONYLS Annual Report, Dec. 1984 - Nov. 1985
D. F. Shriver and C. Woodcock Jan. 1986 11 p
(Contract GRI-5082-260-0693)
(PB86-174455; GRI-86/0015) Avail: NTIS HC A02/MF A01 CSCL 07D

Three basic organometallic compounds, Fe(phen)2(CN)2, Cp4Fe4(CO)4, and CpFe(CO)2CN, have been studied in the AlCl3/n-butylpyridinium chloride, (BPC) molten salt system. IR and UV-VIS spectroscopy show that the ligands of all three complexes interact with Lewis acids contained in the melts. Comparison of spectral shifts for these compounds in the various melts with shifts previously reported for isolated Lewis acid adducts of the same compounds provides insight into the relative electron pair acceptor ability of the various melts. Cyclic voltammetry of Fe(phen)2(CN)2 in the molten salts demonstrates a very large shift in the oxidation potential with increasing acidity whereas the oxidation potential of Cp4Fe4(CO)4 is unchanged. This behavior is consonant with simple molecular orbital calculations. GRA

N86-28159# Stanford Univ., Calif. Dept. of Chemistry.
ELECTROCHEMICAL ACTIVATION OF CARBON DIOXIDE Annual Report, 15 Oct. 1984 - 14 Oct. 1985
N. S. Lewis Jan. 1986 47 p
(Contract GRI-5094-260-1015)
(PB86-174380; GRI-85/0274) Avail: NTIS HC A03/MF A01 CSCL 07D

The authors are attempting to bind a variety of cobalt-based macrocycles to electrode surfaces, and to assess their activity towards CO2 reduction. Cobalt-based systems are being pursued at present because they are known to possess the necessary oxidation states, hydride and proton binding sites, and reactivity patterns which are required to effect multi-electron transformations on inorganic fuel precursors. In parallel with the study, the authors are also pursuing work designed to elucidate changes in fundamental reactivity patterns as a result of immobilization of molecules on electrode surfaces. The authors have developed techniques which allow, for the first time, an investigation of the intrinsic reactivity of simple transition metal ions, such as Ru(NH3)5(H2O)2+ in polymer films. Kinetic and spectroscopic methods have been used to probe reactivity variations in this system. Also, thermodynamic information regarding the local solvent sphere of these ions and the factors which control binding of these charged species into ionophores have been performed. GRA

N86-28160# National Bureau of Standards, Gaithersburg, Md. Molecular Spectroscopy Div.
TECHNICAL ACTIVITIES 1985, MOLECULAR SPECTROSCOPY DIVISION
A. Weber Jan. 1986 110 p
(PB86-164381; NBSIR-86/3313) Avail: NTIS HC A06/MF A01 CSCL 07D

The technical activities of the National Bureau of Standards (NBS) Molecular Spectroscopy Division during the Fiscal Year 1985 are summarized. The activities span experimental and theoretical research in high resolution molecular spectroscopy, quantum chemistry and laser photochemistry, and include the development of frequency standards, critically evaluated spectral data, applications of spectroscopy to important scientific and technological problems, as well as advancement of spectroscopic measurement methods and techniques. GRA

N86-28161# National Bureau of Standards, Gaithersburg, Md.
INTRODUCTION TO FOURIER TRANSFORM SPECTROSCOPY
J. Cohen Mar. 1986 102 p
(PB86-182300; NBSIR-86-3339) Avail: NTIS HC A06/MF A01 CSCL 07D

Presented is a simplified, concise introduction to Fourier Transform spectroscopy. The emphasis is on concepts and comprehension, and abundant diagrams are provided as an aid. The work is organized into three parts: first, a selective, but adequate review of Fourier transform mathematics, next, a treatment of the physics of a simple Michelson interferometer, and last, salient topics in Fourier transform spectroscopy. GRA

N86-28162# Sandia National Labs., Albuquerque, N. Mex.
HECTR ANALYSES OF LARGE-SCALE PREMIXED HYDROGEN COMBUSTION EXPERIMENTS
C. Channy Wong 1986 9 p Presented at the International ANS/ENS Topical Meeting on Thermal Reactor Safety, San Diego, Calif., 2-6 Feb. 1986
(Contract DE-AC04-76DP-00789)
(TI86-004611; SAND-85-1652C; CONF-860204-18) Avail: NTIS HC A02/MF A01

The HECTR (Hydrogen Event: Containment Transient Response) computer code is a reactor accident analysis tool designed to calculate the transport and combustion of hydrogen and the transient response of the containment. As part of the assessment effort, HECTR was used to analyze the Nevada Test Site (NTS) large-scale premixed hydrogen combustion experiments. The results of these analyses and the critical review of the combustion modle in HECTR is presented. Author

N86-28213# Atlantic Research Corp., Alexandria, Va.
EFFECTS OF OXIDIZER DEPLETION ON BORON CLOUD COMBUSTION TIME
Merrill K. King *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 1-11 (For primary document see N86-28212 19-28)
(Contract F49260-81-C-0035)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28216*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EROSIVE BURNING RESEARCH
L. Strand, L. Yang, R. Ray, and J. Barry *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 29-40 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28218# Army Armament Munitions and Chemical Command, Dover, N.J.
SINGLE-SHOT H2 CARS SPECTROMETRY OF PROPELLANT IGNITION AND COMBUSTION, UNDER PRESSURE
T. E. Haw (Geo-Centers, Inc., Newton, Mass.), S. Darrah, and L. E. Harris *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 55-64 (For primary document see N86-28212 19-28)
(Contracts DAAK10-81-C-0265; DAAA21-85-C-0139)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28219# Morton Thiokol, Brigham City, Utah.
ROCKET PROPELLANT IGNITION: A WORKSHOP REPORT
M. Salita *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 65-86 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28220# Atlantic Research Corp., Gainesville, Va. Ignition Tech. Internal Research and Development.
A ROCKET MOTOR IGNITION MODEL UTILIZING IGNITION DELAY VERSUS PRESSURIZATION RATE DATA

J. E. Wills *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 87-96 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28221# Cohen (Norman S.) Professional Services, Inc., Redlands, Calif.
ANALYTICAL MODELS OF COMBUSTION RESPONSE FUNCTIONS
Norman S. Cohen *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 97-102 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28222# Georgia Inst. of Tech., Atlanta.
NONLINEAR COMBUSTION INSTABILITY
G. A. Flandro *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 103-112 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28224# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
A NUMERICAL MODEL FOR THE RIJKE BURNER
R. L. Raun and M. W. Beckstead *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 123-131 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0157-83)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28227# United Technologies Corp., San Jose, Calif.
COUPLING BETWEEN VELOCITY OSCILLATIONS AND SOLID PROPELLANT COMBUSTION
R. S. Brown, A. M. Blackner, P. G. Willoughby, and R. Dunlap *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 151-160 Previously announced in IAA as A86-19933 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28233# Applied Combustion Technology, Inc., Orlando, Fla.
ANALYSIS OF TWO-PHASE IGNITER FLOW THROUGH A GRANULAR BED
A. Michael Varney, John Martino, Saeed Ghandeharioun, Bryan Steury, and Charles Irish (Naval Ordnance Station, Indian Head, Md.) *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 209-221 (For primary document see N86-28212 19-28)
(Contract N00174-83-C-0254)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28236# University of Southern California, Los Angeles.
A NOVEL FEEDBACK CONCEPT FOR COMBUSTION INSTABILITY IN RAMJETS
P. Roy Choudhury, Melvin Gerstein, and Reza Mojaradi *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 279-287 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0222-82)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28238*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CARS SYSTEM FOR SIMULTANEOUS MEASUREMENT OF TEMPERATURE, NITROGEN AND OXYGEN DENSITIES IN A TURBULENT FLAME
Olin Jarrett, Jr., Richard R. Antcliff (Systems Research Labs., Inc., Dayton, Ohio), and R. Clayton Rogers *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 295-306 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28246# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
IGNITION AND COMBUSTION OF ALUMINUM AND ALUMINUM/CARBON SLURRY DROPLETS
S. R. Turns and S.-C. Wong *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 383-398 (For primary document see N86-28212 19-28)
(Contract F33615-84-C-2410)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28247*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMBUSTION IN SUPERSONIC FLOW
G. Burton Northam *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 399-410 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28248# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC COMBUSTION OF A SILANE/METHANE MIXTURE
G. Burton Northam and Allen G. McLain *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 411-416 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28249# United Technologies Research Center, East Hartford, Conn.
CARS FEASIBILITY DEMONSTRATION IN SUPERSONIC COMBUSTING FLOWS
Torger J. Anderson, Ira W. Kay, and William T. Peschke *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 417-428 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28251# Colorado State Univ., Fort Collins.
IMPROVEMENT OF AN INTEGRAL STABILITY MODEL
C. E. Mitchell *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 443-452 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28257# Naval Weapons Center, China Lake, Calif.
A SIMULTANEOUS MATHEMATICAL TREATMENT OF DEFLAGRATION AND IGNITION PHENOMENA
C. F. Price and T. L. Boggs *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 505-513 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28258# Naval Research Lab., Washington, D. C. Chemistry Div.
KINETIC MODELING OF DIMETHYLNITRAMINE THERMAL DECOMPOSITION: A MECHANISTIC EXTRAPOLATION TO RDX DECOMPOSITION IN THE GAS PHASE
M. E. Umstead, S. A. Lloyd, and M. C. Lin *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 515-521 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-28163*# National Aeronautics and Space Administration, Washington, D.C.
METHOD FOR THE PRODUCTION OF STRONGLY ADHESIVE FILMS ON TITANIUM AND TITANIUM ALLOYS WITH A METALLIZATION PROCESS
H.-J. Hahn Jun. 1986 9 p Transl. into ENGLISH of West Germany Patent no. 2442742 (3 Jul. 1975) p 1-4 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-4005)
(NASA-TM-88461; NAS 1.15:88461) Avail: NTIS HC A02/MF A01 CSCL 11F

A process for the spray-application of a strongly adhesive, thick antifriction layer on titanium and titanium alloys is proposed. The titanium/titanium alloy component to be coated is first subjected to cleaning in a pickling bath with reducing additives and sand-blasting, then coated with an intermediate layer of nickel, after which the final layer is applied. The formation of TiNi at the interface ensures strong bonding of the antifriction layer. Author

N86-28164*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROMECHANISMS OF THERMOMECHANICAL FATIGUE: A COMPARISON WITH ISOTHERMAL FATIGUE
Robert C. Bill 1986 21 p Presented at the International Spring Conference Fatigue at High Temperatures, Paris, France, 9-11 Jun. 1986; sponsored by the Societe Francaise de Metallurgie Prepared in cooperation with Army Aviation Research and Technology Activity, Cleveland, Ohio
(NASA-TM-87331; E-3075; NAS 1.15:87331; USAAVSCOM-TR-86-C-7) Avail: NTIS HC A02/MF A01 CSCL 11F

Thermomechanical Fatigue (TMF) experiments were conducted on Mar-M 200, B-1900, and PWA-1480 (single crystals) over temperature ranges representative of gas turbine airfoil environments. The results were examined from both a phenomenological basis and a micromechanical basis. Depending on constituents present in the superalloy system, certain micromechanisms dominated the crack initiation process and significantly influenced the TMF lives as well as sensitivity of the material to the type TMF cycle imposed. For instance, high temperature cracking around grain boundary carbides in Mar-M 200 resulted in short in-phase TMF lives compared to either out-of-phase or isothermal lives. In single crystal PWA-1480, the type of coating applied was seen to be the controlling factor in determining sensitivity to the type of TMF cycle imposed. Micromechanisms of deformation were observed over the temperature range of interest to the TMF cycles, and provided some insight as to the differences between TMF damage mechanisms and isothermal damage mechanisms. Finally, the applicability of various life prediction models to TMF results was reviewed. Current life prediction models based on isothermal data must be modified before being generally applied to TMF. Author

N86-28165*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPRESSIVE CREEP BEHAVIOR OF ALLOYS BASED ON B2 FeAl
N. Mantravadi (Case Western Reserve Univ., Cleveland, Ohio), K. Vedula, D. Gaydosh, and R. H. Titran 1986 16 p Presented at the IMS-AIME Annual Meeting, New Orleans, La., 2-6 Mar. 1986 (Grant NsG3-387)
(NASA-TM-87293; E-3000; NAS 1.15:87293) Avail: NTIS HC A02/MF A01 CSCL 11F

Alloys based on FeAl are attractive alternate materials for environmental resistance at intermediate temperatures. Addition of small amounts of Nb, Hf, Ta, Mo, Zr, and B were shown to improve the compressive creep of this alloy at 1100 K. Boron, in particular, was found to have a synergistic effect along with Zr in providing properties substantially better than the binary alloy. This improvement seems to be related to the higher activation energy found for this alloy, suggesting a modification in the diffusion behavior due to the alloying additions. Author

N86-28166*# Battelle Columbus Labs., Ohio.
THE INFLUENCE OF DEFECTS OF THE FATIGUE RESISTANCE OF BUTT AND GIRTH WELDS IN A106B STEEL Final Report
B. N. Leis, D. P. Goetz, and P. M. Scott Jul. 1986 108 p
(Contract NAS1-17404)
(NASA-CR-178114; NAS 1.26:178114) Avail: NTIS HC A06/MF A01 CSCL 11F

This three-phase study was directed at developing a fitness for service defect acceptance criteria for welds with defect indications. The study focussed on A106 Gr. B steel pipe. The first phase involved a literature search and critical review to develop the preliminary acceptance criteria to the extent permitted by the data. The second phase developed data for flat plate, wall segment, and vessel specimens containing artificial or natural planar or volumetric defects. The final phase developed acceptance criteria from the test data. Author

N86-28167# Army Armament Research and Development Command, Dover, N. J. Armament Engineering Directorate.
NEUTRON DIFFRACTION CHARACTERIZATION OF TUNGSTEN-NICKEL-IRON ALLOYS Preliminary Technical Report, 1984 - 1985
H. J. Prask and C. S. Choi Feb. 1986 26 p
(AD-A165796; AD-E401461; ARAED-TR-85015) Avail: NTIS HC A03/MF A01 CSCL 07/4

Neutron diffraction and small-angle scattering have been employed to elucidate the effect of strain aging on macroscopic properties of tungsten-nickel-iron (W-.07Ni-.03Fe) alloys. The neutron measurements indicate that strain aging causes reduction and redistribution of residual stresses induced by swaging, accompanied by void/precipitate evolution. GRA

N86-28168# Avco-Everett Research Lab., Mass.
LASER METALWORKING TECHNOLOGY TRANSFER Final Report
Ole A. Sandven 1986 84 p
(Contract N00014-82-C-2373)
(AD-A165808) Avail: NTIS HC A05/MF A01 CSCL 11/6

The Technology Transfer program assists in the utilization and integration of the laser facility in the manufacturing of naval ordnance components and systems. This assistance consists of targeting workpieces and production steps suitable for laser processing in terms of cost effectiveness and quality enhancement, the development of techniques and procedures for such processing and the establishment of processing parameters and other pertinent data. The work is related to laser surface transformation hardening of steels. The response of a number of frequently used steels to such laser processing has been determined over a wide range of processing parameters. Models and calculator programs for the prediction of laser hardening have been developed and tested, and the necessary thermophysical constants of the various materials determined by statistical and empirical means. In addition to the transformation hardening survey, process development work relating to the laser hardfacing of aircraft carrier catapult rails has been performed, and preliminary techniques and processing data established for different combinations of hardfacing alloys/substrate materials. GRA

N86-28169# Materials Research Labs., Ascot Vale (Australia).
CONTROLLING CORROSION IN DEFENCE EQUIPMENT TECHNICAL MEETING
D. A. Wright Oct. 1985 71 p Meeting held in Maribyrnong, Australia, 27 Mar. 1985
(AD-A165834; MRL-R-964) Avail: NTIS HC A04/MF A01 CSCL 11/6

Presentations at this Technical Meeting covered a wide range of corrosion theory and practical control measures. Topics range from protective measures such as electroplating, painting and surface modification, through ways of minimizing corrosion by suitable equipment design, to overviews of stress corrrosion cracking and the monitoring of corrosion. Case histories of corrosion-induced failures in material that are typically representative of control problems, and estimates of the cost of corrosion to Defence are given in some detail. The meeting sought to expand and update the long established, and productive, liaison between MRL corrosion scientists and the Armed Services and Defence Factories in this important and costly area. Corrosion expertise immediately available to Defence personnel was highlighted, as were current developments in corrosion control areas in which MRL research and development is either presently active or could be deployed should Defence requirements so dictate. It was hoped,

therefore, to show MRL's customers how to obtain advice on corrosion more effectively from present scientific resources, on to developments in corrosion technology that might have future application in their work. Author (GRA)

N86-28170# Technical Research Centre of Finland, Espoo.
EFFECT OF DECONTAMINATION ON OXIDATION OF AUSTENITIC STAINLESS STEEL IN REACTOR CONDITIONS
T. Starkman Jul. 1984 120 p In FINNISH; In FINNISH
(DE86-700116; VTT-TUTK-289) Avail: NTIS (US Sales Only) HC A06/MF A01

Austenitic stainless steels were oxidized in static autoclaves in light water reactor conditions. After the autoclave treatments the specimens were decontaminated with the aid of alkaline potassium permanganate (AP) and oxalic acid and citric acid (CITROX) as well as electrochemically in H3PO4. Alternating oxidation and decomtamination tests were performed. An elemental analysis of the surfaces of the specimens was carried out by electron spectroscopy. Changes in structure and thicknesses of the oxide layers were observed. Author

N86-28171# Minnesota Univ., Minneapolis. Corrosion Research Center.
CORROSION RESEARCH CENTER OF THE UNIVERSITY OF MINNESOTA Progress Report, Jan. 1 - 31 Dec. 1985
R. A. Oriani Dec. 1985 209 p
(Contract DE-FG02-84ER-45173)
(DE86-004404; DOE/ER-45173/1-1985) Avail: NTIS HC A10/MF A01

The following topics in aqueous and high-temperature corrosion were studied: passivation on GaAs, adsorption on electrode surfaces, passive films on Ti, corrosion protection by conductive polymers, interfaces, scaling and molten carbonates. DOE

N86-28172# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
INVESTIGATION OF MICROSTRUCTURAL CHANGES IN FERRITIC STAINLESS STEELS CAUSED BY HIGH TEMPERATURE DEFORMATION Final Report, 15 Sep. 1981 - 30 Nov. 1985
J. R. Weertman Nov. 1985 33 p
(Contract DE-AC02-81ER-10960)
(DE86-004509; DOE/ER-10960/10) Avail: NTIS HC A03/MF A01

The low cycle fatigue behavior of several ferritic stainless steels (primarily Fe9Cr1Mo + V,Nb) was studied under total strain control at elevated temperatures. The effects of strain range, temperature, environment, and prior heat treatment were evaluated. The accompanying microstructural changes were observed by conventional and high voltage TEM and carbide coarsening was followed by small-angle neutron scattering (SANS). Substantial softening was observed in all fatigue tests. The introduction of hold times at maximum strain decreases cycle life but extends time to failure. The stress relaxes markedly during these hold times. Fatigue life is much shorter in air than in vacuum, especially at low strain ranges. The presence of air appears to increase softening. Prior aging or raising the temperature decreases the stress range but, in the case of continuous cycling under vacuum, cycle life is determined primarily by the plastic strain amplitude. Microstructural changes responsible for the observed softening include: change from the original lath dislocation structure to cells or subgrains; large decrease in the originally high dislocation density; carbide coarsening. Information obtained from SANS measurements on carbide coarsening during high temperature deformation or aging is in good agreement with HVEM observations and mechanical behavior. DOE

N86-28173# Argonne National Lab., Ill.
TRANSPORT MECHANISMS IN BETA-LITHIUM/ALUMINUM: AN OVERVIEW
S. Susman, T. O. Brun, and K. J. Volin Oct. 1985 4 p Presented at the International Workshop on High Temperature Molten Salt Batteries, Argonne, Ill., 5 Nov. 1985
(Contract W-31-109-eng-38)
(DE86-004036; CONF-851192-2) Avail: NTIS HC A02/MF A01

There is a critical composition within the phase domain corresponding to 50.7 at. % Li. This composition partitions the Li conduction mechanism problem into four regions: room temperature (RT) for x V 0.507, RT for x 0.507, high temperature (HT) for x V 0.507, and HT for x > 0.507. The point defects and dimeric defects necessary to account for observed variations in Li diffusion have been determined for the first 3 regions; the fourth region is still being investigated. DOE

N86-28174# Oak Ridge National Lab., Tenn.
MECHANICAL PROPERTIES OF METALLIC FILMS ON SAPPHIRE
F. A. List and R. A. McKee 1985 5 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE86-005159; CONF-851217-29) Avail: NTIS HC A02/MF A01

A knowledge of interfacial mechanical properties is of considerable importance to the areas of oxidation, corrosion, metallization, and composite materials. We have developed an experimental apparatus capable of simultaneous measurements of elastic and anelastic properties of materials in controlled atmospheres (10 to 10 Pa) from 25 to 1000 C. The apparatus employs the technique of dynamic resonance in which a material's mechanical resonance spectrum can be determined over a range 10 to 10 Hz with resolution + or - 0.001 Hz. This resolution has enabled us to determine the mechanical properties of films as thin as approximately 10 nm. We present resonance results for thin films (approx. 100 nm) of nickel and gold on sapphire substrates. Results suggest that nickel films on sapphire are adherent, i.e., cyclic strain is continuous at the film-substrate interface, over a range of temperature about the film growth temperature; whereas gold films show nonadherent behavior at all temperatures studied. DOE

N86-28175# Argonne National Lab., Ill.
ION BEAM MIXING IN BINARY AMORPHOUS METALLIC ALLOYS
H. Hahn, R. S. Averback, T. Diazde la Rubia, and P. R. Okamoto Dec. 1985 8 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985 Prepared in cooperation with New York State Univ., Albany
(Contract W-31-109-eng-38)
(DE86-005526; CONF-851217-36) Avail: NTIS HC A02/MF A01

Ion beam mixing (IM) was measured in homogeneous amorphous metallic alloys of Cu-Er and Ni-Ti as a function of temperature using tracer impurities, i.e., the so-called marker geometry. In Cu-Er, a strong temperature dependence in IM was observed between 80 and 373°K, indicating that radiation-enhanced diffusion mechanisms are operative in this metallic glass. Phase separation of the Cu-Er alloy was also observed under irradiation as Er segregated to the vacuum and SiO interfaces of the specimen. At low-temperatures, the amount of mixing in amorphous Ni-Ti is similar to that in pure Ni or Ti, but it is much greater in Cu-Er than in either Cu or Er. DOE

N86-28176# Argonne National Lab., Ill.
CORROSION OF ALLOYS IN MIXED GASES
K. Natesan Dec. 1985 17 p Presented at the 168th Meeting of the Electrochemical Society, Las Vegas, Nev., 13 Oct. 1985
(Contract W-31-109-eng-38)
(DE86-005541; CONF-851048-12) Avail: NTIS HC A02/MF A01

Corrosion of materials at elevated temperatures is a potential problem in many systems within the chemical, petroleum, and power-generation industries. Multicomponent gas environments are generally prevalent in a number of these systems; the interactions between the complex gas atmospheres and materials of construction can lead to wastage and can alter the structural integrity of the materials. Thermodynamic and kinetic aspects of corrosion processes occurring in complex gas mixtures are discussed. Further, possible mechanisms are enumerated to evaluate the long-term performance of materials in complex gas environments. DOE

N86-28177# Argonne National Lab., Ill.
EVOLUTION OF PHASE MICROSTRUCTURE DURING IRRADIATION
H. Wiedersich Nov. 1985 33 p Presented at the Workshop on the Relation Between Mechanical Properties and Micro-structure Under Fusion Irradiation Conditions, Ebeltoft, Denmark, 27 Jun. 1985
(Contract W-31-109-eng-38)
(DE86-005544; CONF-8506165-5) Avail: NTIS HC A03/MF A01

The phase microstructure of alloys is frequently severely altered during irradiation. Sluggish precipitation reactions including precipitation coarsening are accelerated by irradiation-enhanced diffusion. Radiation-induced segregation redistributes existing precipitate phases within the microstructure, induces precipitation of nonequilibrium phases and affects the composition of phases in multicomponent alloys. The displacement process causes disordering of ordered alloys and frequently amorphization, especially in intermetallic compounds, at low temperature. Although a good qualitative understanding of the basic process involved, i.e., displacement mixing, radiation-enhanced diffusion and radiation-induced segregation exists, methods for detailed quantitative modeling of the evolution of the microstructure of alloys remain to be developed. DOE

N86-28178# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
SURFACE COMPOSITION-REACTIVITY RELATIONSHIPS IN HETEROGENEOUS CATALYSIS Progress Report
A. Brenner Jan. 1986 7 p
(Contract DE-AC02-79ER-10381)
(DE86-005907; DOE/ER-10381/7) Avail: NTIS HC A02/MF A01

Temperature programmed reduction/oxidation has been carried out up to 1200 C on 2% metal on alumina supports. H-D exchange was studied over Mo on alumina and silica supports. Decomposition of Mo(CO) was studied. Benzene hydrogenation over carbonyls of many transition metals was studied in detail. DOE

N86-28179# California Univ., Berkeley. Lawrence Berkeley Lab.
LOW CARBON DUAL PHASE STEELS FOR HIGH STRENGTH WIRE
G. Thomas and J. H. Ahn Aug. 1985 32 p Presented at the 55th Annual Convention: Interwire '85, Atlanta, Ga., 3 Nov. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001481; LBL-20141; CONF-8511125-1) Avail: NTIS HC A03/MF A01

This paper shows that dual phase steels can be designed and processed as new, economical low carbon steels for cold drawing into high tensile strength steel wires. Current work indicates wires of tensile strengths up to 400,000 psi can be obtained. Potential applications for dual phase steel wire include bead wire, tire cord, wire rope and prestressed concrete. It should be possible to produce wire rods in existing rod mills by adapting the controlled rolling and quenching procedures outlined in this paper. DOE

N86-28180# Vereinigte Aluminium-Werke A.G., Bonn (West Germany). Technische Beratung und Entwicklung.
WARP-FREE REFINEMENT OF ALUMINUM STRIP Final Report, Sep. 1984
Hans-Heinrich Plath Bundesministerium fuer Forschung und Technologie Nov. 1985 78 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-125; ISSN-0340-7608; ESA-86-96892) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16.50

An aluminum strip heat treatment process, whereby heat transfer is achieved by contact with internal cooled rolls to avoid warp deformation, was developed. Stresses arising in a strip during the quench procedure were predetermined by data processing. Fundamental relations between important parameters were thus obtained, and conditions for practical try-out of the process were determined. The experimental concept included solution annealing of coiled test strips in a closed chamber and quenching with two cooling rolls operating in series. Theoretical calculations according to which stresses resulting from quenching can be reduced to a noncritical level are confirmed by laboratory tests. ESA

N86-28181# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Angewandte Physik.
METAL PROCESSING WITH UV LASERS Final Report, Oct. 1983
Reinhart Poprawe Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 46 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-140; ISSN-0340-7608; ESA-86-96894) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.50

A medium power transversely excited excimer laser system (p = 25 W) was developed. The system is suited for metal processing in the submicrometer range. Special attention was paid to homogenization of the KrF-gas discharge to optimize beam quality. For material ablation with ultraviolet pulsed lasers, the reciprocal processes between beam, workpiece and material vapor, as well as the impact of the processes on quality and the operation degree, were examined. Matching the laser parameters to the interaction phenomena results in high quality and efficient ablation. ESA

N86-28182# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE CRACK GROWTH DATA FOR STEEL N-A-XTRA 56. PART 2: WELD METAL AND HEAT AFFECTED ZONE
Anders F. Blom Jul. 1985 23 p
(Contracts STEV-506-101-7; STEV-506-101-8)
(FFA-TN-1985-44-Pt-2; ESA-86-97052) Avail: NTIS HC A02/MF A01

Fatigue crack growth data were obtained for the weld metal and for the heat affected zone at three different R-values (R = 0.2, 0.5 and 0.8) of wind turbine rotor steels. It is found that although at higher crack growth rates cracks may grow faster in weld metal and heat affected zone than in base material, the near-threshold crack growth rates are slower in weld metal and heat affected zone than in base material. This is beneficial for the overall lifetime of the wind turbine since cracks are likely to initiate at welds and the near-threshold regime largely determines the fatigue behavior, due to the large number of load cycles the turbine blades are designed to sustain during their required safe service life of 30 Yr. ESA

N86-28183# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
SHORT FATIGUE CRACK GROWTH IN Al 2024 AND Al 7475
A. F. Blom, A. Hedlund, W. Zhao, A. Fathulla, B. Weiss, and R. Stickler Nov. 1985 47 p Presented at Symposium on Behavior of Short Fatigue Cracks, Sheffield, England, 25-28 Sep. 1985 Submitted for publication Sponsored by Fonds zur Foerderung der Wissenschaftlichen Forschung und Hochschuljubilaeumsstiftung der Stadt Wien
(Contract STU-84-4563)
(FFA-TN-1985-67; ESA-86-97054) Avail: NTIS HC A03/MF A01

Fatigue crack initiation and growth in two high strength technical Al-alloys differing in mechanical properties and microstructure were investigated at low load amplitudes slightly below and above the high-cycle fatigue limit (0.9 to 1.4 times the fatigue limit, 0.2 to 0.9 times the yield strength). The effect of stress ratios (-1 to 0.7) and short and long crack growth properties for identical specimen material, orientation, and test conditions were studied. For the determination of closure stresses a dynamic compliance technique was developed and the crack opening phenomena followed by microscopic methods. Initiation and growth of fatigue cracks strongly depend on microstructural features (second phase particles, grain boundaries). A comparison of the growth behavior of microstructurally-short and physically-short cracks with that of

long cracks shows that the peculiarities of short crack growth can be partly related to crack closure phenomena. ESA

N86-28184# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Lab. Soete for Strength of Materials and Welding Technology.
INFLUENCE OF A POST WELD HEAT TREATMENT ON THE TOUGHNESS OF WELDMENTS IN LOW TEMPERATURE STEEL GRADES T St E 460 AND ASTM A 537 Cl 1
W. Provost Dec. 1985 40 p Sponsored by Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture and Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques
(CRIF-MT-163; ESA-86-97061) Avail: NTIS HC A03/MF A01

The influence of post weld heat treatment (PWHT) on the toughness of welded joints in three low temperature steel grades was investigated. Results show that PWHT produces a significant drop in HAZ and WMC toughness for the two T ST E 460 steels A and B. Stress relieving of this steel grade should be omitted. Fracture toughness tests, including wide plate testing, show evidence of an acceptable toughness level of the welds in steel A in the as welded condition. In contrast with the satisfactory Charpy V toughness, rather low CTOD values are observed in the HAZ of steel B in the as welded condition. A significant improvement in Charpy V and CTOD toughness by PWHT is demonstrated for steel C. However, acceptable toughness levels are also obtained in the as welded condition. This is reflected by the wide plate test results, implying that PWHT is superfluous, at least up to the tested plate thickness. ESA

N86-28185# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
RESULTS OF CHEMICAL CORROSION TESTING OF ELECTROSLAG-REMELTED CrNi STAINLESS STEEL AISI 340 L (MATERIAL NO. 1.4306) IN NITRIC ACID
R. Kraft, S. Leistikow, and E. Pott Nov. 1985 68 p In GERMAN; ENGLISH summary
(KfK-3878; ISSN-0303-4003; PWA-20/85; ESA-86-96910) Avail: NTIS HC A04/MF A01

The extra-low-carbon quality of the CrNi stainless steel AISI 304, additionally purified by the electroslag-remelting process, was tested as forged and rolled (sheet) material in nitric acid of different concentrations and temperatures for application in nuclear fuel reprocessing plants. All tests of solution-annealed materials in boiling 65% nitric acid show a very low constant of uniform metal dissolution. The specimens exposed in the vapor phase of the boiling aceotropic nitric acid show a corrosion attack comparable in quality and quantity to that in the liquid phase. No impairment of corrosion resistance is observed after annealing at 550 and 600 C; solution-annealing at 950, 1050, and 1100 C; and cold deformation (10% to 80%) by rolling of the material. Parameter studies show a slight dependence of corrosion of forged and rolled materials on the bulk structure after 1hr heat treatment at 650 to 750 C. A decrease of temperature and nitric acid concentration minimizes the metal dissolution rate while addition of Cr-6 ions to the aceotropic acid strongly increases it. ESA

N86-28186# National Bureau of Standards, Gaithersburg, Md.
MATERIALS TECHNOLOGY FOR ELECTRICAL APPLIANCES: MAGNETIC AND ELECTRICAL PROPERTIES OF METALS AND ALLOYS
G. N. Dubinin and Y. S. Avraamov 1985 277 p Transl. into ENGLISH of the mono. "Konstruktsionnye, Provodnikove i Magnitnye Materialy (Elektromaterialovedenie)" Moscow, USSR, Mashinostroenie, 1973 p 1-268 Sponsored by NSF
(PB86-184314; TT-79-52021) Avail: NTIS HC A13/MF A01 CSCL 11F

Described are the theoretical principles of the materials technology for electrical appliances used in aviation instrumentation. Major attention has been paid to the structure and properties of metals and alloys used in modern aviation instrumentation. The authors have elaborated the relationship between the structure and physiochemical properties of alloys. Various methods of developing special properties in alloys have been described. A considerable part of the book has been devoted to the study of special-purpose alloys such as soft and hard magnetic materials, ferrites, alloys with special thermal and electrical properties, and semiconductors. Students in aviation institutes will find the book very useful. Aviation, electrical and mechanical engineers engaged in the development of electrical appliances will also benefit from the book. GRA

N86-28187 United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
EFFECTIVE CORROSION MONITORING
C. F. Britton and B. C. Tofield Nov. 1985 14 p
(AERE-R-12007) Copyright. Avail: Issuing Activity

Results of two surveys (carried out in 1981 and 1984), of users of corrosion monitoring equipment are described. The benefits to be obtained from a well designed corrosion monitoring system, especially if a corrosion control program is utilized, are outlined together with the difficulties and barriers that can obstruct successful application. Developing methods such as ac impedance, electrochemical noise and TLA (thin layer activation) are discussed in view of the comments received from the surveys. Author

N86-28188 Newcastle-upon-Tyne Univ. (England). Materials Development Div.
AN ASSESSMENT OF THE RISK OF EMBRITTLEMENT OF A STEEL CONTAINER BY HYDROGEN PICKED UP FROM THE OPEN BED
D. Hardie Sep. 1985 72 p
(AERE-G3587) Copyright. Avail: NTIS HC A04/MF A01

A realistic assessment of the likelihood of embrittlement of a plain carbon steel container for nuclear waste has been made by estimating the hydrogen levels that might be expected to develop in the steel as a consequence of the slow corrosion of the container and the possible effect that such a hydrogen concentration would have on its mechanical behavior. By consideration of various possible models for the generation of hydrogen and its subsequent uptake into the steel or dissemination in the environment, it is concluded that the most pessimistic assessment of the concentration of hydrogen that could build-up in the container walls during 1000 years burial would not significantly affect the resistance to failure of even relatively high strength steels. Author

N86-28189# Brookhaven National Lab., Upton, N. Y.
DETECTION OF DEFECTS IN ION VAPOUR DEPOSITED ALUMINUM ON STEEL
Hugh S. Isaacs 1986 8 p
(TI86-006884; BNL-37598) Avail: NTIS HC A02/MF A01

Defects in ion vapor deposited aluminum coatings on steel exposed to a 0.3M H3BO4 solution adjusted to pH 3 with NaOH were detected in-situ. The nonaggressive borate solution was chosen to prevent any significant damage to the coating during defect location. The defects were located using a scanning vibrating probe electrode which measured the distribution of current density above the surface of the coated steel. The vibrating probe technique enabled polarization measurements of specific areas of the surface to be made. The polarization measurements of the defect sites showed that they were not a result of exposed steel but were caused by the presence of inclusions. Author

N86-28190# Ames Lab., Iowa.
STEEL CONTAINMENT RESISTANCE UNDER GENERAL DYNAMIC PRESSURES
L. Greimann, F. Fanous, and D. Bluhm Feb. 1986 150 p
(Contract NRC-FIN-A4134)
(TI86-006950; NUREG-CR-4223) Avail: NTIS HC A07/MF A01

Severe accident loadings on containments can include combinations of uniform internal pressure, dynamic pressure and seismic loadings. The objective of this work is to develop a methodology for calculating the ultimate capacity of steel containments under very general global or local, uniform or spatially varying dynamic loadings. An axisymmetric geometric model is used and the

circumferential variation of the loads is expressed in terms of Fourier series components. The solution, i.e., displacement and stress resultants at any point of time, are obtained and also represented by Fourier series components. Values of these components at discrete locations are evaluated using modal superposition. Failure, i.e., leakage of the containment, is defined to occur when either the membrane strain in the shell reaches twice the shell material yield strain or a bifurcation point occurs. A computer program called LOADS was written to evaluate the point-in-time displacements and stress resultants. This program uses the results obtained from a modified BOSOR4 modal analysis program. The results of the LOADS program are input into a modified BOSOR5 computer code to evaluate the containment resistance which considers large deformation and material nonlinear behavior. A user's manual for the BOSOR4/LOADS/BOSOR5 program set is presented. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-28191 National Physical Lab., Teddington (England). Div. of Materials Applications.
ON STANDARD PROCEDURES FOR THE PRESENTATION OF MULTIPOINT DATA ON POLYMERS Interim Report
G. Dean Dec. 1985 20 p
(NPL-DMA(A)111; ISSN-0143-7313; ESA-86-97130) Copyright. Avail: Issuing Activity

Recommended tests and test conditions for the presentation of multipoint data on polymers are listed. ESA

N86-28192 National Physical Lab., Teddington (England). Div. of Materials Applications.
THE APPLICATION OF ACOUSTIC SURFACE WAVES TO THE CHARACTERISATION OF POLYMERS
G. D. Dean Dec. 1985 27 p
(NPL-DMA(A)112; ISSN-0143-7313; ESA-86-97131) Copyright. Avail: Issuing Activity

Apparatus for launching and receiving acoustic surface waves in polymers is described. The influences on wave velocity of internal stress, molecular orientation, physical aging, and absorbed water in polymethylmethacrylate were investigated. Although high accuracy can be achieved in the determination of changes in wave velocity, very small changes are caused by realistic variations in the parameters investigated, except of water content. The sensitivity of wave velocity to anisotropy is revealed by theoretical analysis for the case of hexagonal symmetry and by measurements on a fiber reinforced plastic and an oriented liquid crystal polymer. The velocity along symmetry directions is close to that of the appropriate bulk shear wave in the material, the proximity depending on the degree of anisotropy. ESA

N86-28193 National Physical Lab., Teddington (England). Div. of Materials Applications.
CHARACTERISATION AND INFLUENCE OF ORIENTATION AND INTERNAL STRESS IN ACRYLIC AIRCRAFT MATERIALS Final Report
B. E. Read, G. D. Dean, and J. C. Duncan Dec. 1985 79 p
(Contract MOD-RAE(F)MT-69/2/10)
(NPL-DMA(A)113; ISSN-0143-7313; ESA-86-97132) Copyright. Avail: Issuing Activity

A photoelastic method for characterizing the internal stresses in crosslinked PMMA acrylic aircraft materials and windows was developed. The time-dependence of optical birefringence during creep or relaxation tests at different temperatures suggests that three nonequilibrium internal stress components operate: stress characteristic of the molecular orientation produced by stretching at high temperature; a glasslike distortional stress; and a stress arising from molecular conformational changes generated by the beta relaxation process in PMMA. A light-scattering technique was used to characterize internal stresses from temperature-dependent birefringence measurements in biaxially oriented materials. Levels of molecular orientation in biaxially stretched sheets and windows correspond to an orientational stress of 2 + or - 0.2 MPa along each of the stretching directions. Internal stresses in the crosslinked acrylic materials can be assessed from surface acoustic wave velocity. ESA

N86-28194*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROGRAVITY POLYMERS
Jun. 1986 22 p Proceedings of a Workshop held in Cleveland, Ohio, 9 May 1985
(NASA-CP-2392; E-2707; NAS 1.55:2392) Avail: NTIS HC A02/MF A01 CSCL 11B

A one-day, interactive workshop considering the effects of gravity on polymer materials science was held in Cleveland, Ohio, on May 9, 1985. Selected programmatic and technical issues were reviewed to introduce the field to workshop participants. Parallel discussions were conducted in three disciplinary working groups: polymer chemistry, polymer physics, and polymer engineering. This proceedings presents summaries of the workshop discussions and conclusions. Author

N86-28195*# College of William and Mary, Williamsburg, Va.
RADIATION EFFECTS ON HIGH PERFORMANCE POLYMERS Final Technical Report, 1 Jun. 1985 - 28 Feb. 1986
Robert A. Orwoll 1986 10 p
(Grant NAG1-593)
(NASA-CR-177191; NAS 1.26:177191) Avail: NTIS HC A02/MF A01 CSCL 11B

Polymer matrix materials are candidates for use in large space antennas and space platforms that may be deployed in geosynchronous orbit 22,500 miles above the Earth. A principal concern is the long term effects of an environment that is hostile to organic polymers, including high energy electromagnetic radiation, bombardment by charged particles, and large abrupt changes in temperature. Two polyarylene ethers which might be utilized as models for polymers in space applications were subjected to dosages of 70 keV electrons up to 3.4 x 10 to the 10th power rad. The irradiated films were then examined to determine the effects of the high-energy electrons. Author

N86-28196*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE EFFECTS OF ENERGETIC PROTON BOMBARDMENT ON POLYMERIC MATERIALS: EXPERIMENTAL STUDIES AND DEGRADATION MODELS
Daniel R. Coulter, Amitava Gupta, Mark V. Smith, and R. E. Fornes 1 Jun. 1986 84 p
(Contract NAS7-918)
(NASA-CR-177161; JPL-PUB-85-101; NAS 1.26:177161) Avail: NTIS HC A04/MF A01 CSCL 11C

This report describes 3 MeV proton bombardment experiments on several polymeric materials of interest to NASA carried out on the Tandem Van De Graff Accelerator at the California Institute of Technology's Kellogg Radiation Laboratory. Model aromatic and aliphatic polymers such as poly(1-vinyl naphthalene) and poly(methyl methacrylate), as well as polymers for near term space applications such as Kapton, Epoxy and Polysulfone, have been included in this study. Chemical and physical characterization of the damage products have been carried out in order to develop a model of the interaction of these polymers with the incident proton beam. The proton bombardment methodology developed at the Jet Propulsion Laboratory and reported here is part of an ongoing study on the effects of space radiation on polymeric materials. The report is intended to provide an overview of the mechanistic, as well as the technical and experimental, issues involved in such work rather than to serve as an exhaustive description of all the results. Author

N86-28197# Vermont Univ., Burlington. Dept. of Chemistry.
ORGANOPHOSPHAZENES. 19. COPOLYMERIZATION OF 2-(2-ETHOXYVINYL) PENTAFLUORO CYCLOTRIPHOSPHAZENE WITH STYRENE AND METHYL METHACRYLATE Technical Report
Christopher W. Allen and Randall P. Bright 14 Mar. 1986 17 p
(Contract N00014-85-K-0558)
(AD-A165716; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

The novel cyclophosphazene, 2-(2-ethoxyvinyl) pentafluorocyclotri phosphazene (N3P3F5C(OC2H5)=CH2) undergoes radical copolymerization with styrene and methyl methacrylate. The styrene system was examined in detail with flame retardant copolymers having up to 43.7% phosphazene content being obtained. Reactivity ratios for the styrene-ethoxyvinyl phosphazene copolymerization have been calculated by several methods. An examination of the Alfrey-Price parameters for the phosphazene indicates that the major perturbation of the olefinic center is through the sigma electron withdrawing effect of the phosphazene. The copolymer molecular weights decrease with increasing phosphazene content. The thermal decomposition of the copolymers is a two step process with the phosphazene being involved in the first step. GRA

N86-28198# Texas A&M Univ., College Station. Mechanics and Materials Research Center.
A MICROMECHANICS MODEL FOR NONLINEAR VISCOELASTIC BEHAVIOR OF PARTICLE-REINFORCED RUBBER WITH DISTRIBUTED DAMAGE
R. A. Schapery Jan. 1986 51 p
(Contract N00014-83-K-0211)
(AD-A165728; MM-4867-86-1) Avail: NTIS HC A04/MF A01 CSCL 11/10

A mathematical model based on micromechanics for predicting effective viscoelastic stress-strain equations and microcrack growth in particle-reinforced rubber (or other relatively soft viscoelastic matrix) is described. Geometric idealization of the microstructure follows that of the composite spheres assemblage and generalized self-consistent scheme originally used for linear elastic composites without damage. The approach combines a perturbation analysis of the matrix, which becomes more accurate as the particle volume fraction is increased, with the Rayleigh-Ritz energy method for predicting mechanical response of the composite. Results for linear elastic and nonlinear viscoelastic behavior are discussed. It is shown that the elasticity theory may be easily extended to predict mechanical response of a viscoelastic composite, and that an approximate equation governing microcrack growth is analogous to one for an aging elastic material. Finally, a limited assessment of the theory is made through comparison with some existing effective modulus results and experimental data on a particle-filled rubber. Author (GRA)

N86-28199# Case Western Reserve Univ., Cleveland, Ohio.
STRESS CRACKING OF POLYETHYLENE IN ORGANIC LIQUIDS Final Report, 1 Sep. 1982 - 31 Dec. 1985
C. E. Rogers 24 Feb. 1986 6 p
(Contract DAAG29-82-K-0174)
(AD-A165733; ARO-19329.3-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

The following results have been obtained in a study of the stress cracking of polyethylene in organic liquids: Fracture mechanics is applicable to both high and low density polyethylene at low and intermediate stress intensity factors. Constant crack speed was found to increase with detergent concentration up to 25% Igepal C0-630. William's flow model was found to be inadequate to describe crack propagation. An aggressive environment, which has micellar solution structure, was found to be effective in cracking compared to the one having nonmicellar structure. GRA

N86-28200# Oklahoma State Univ., Stillwater.
MACROPOROUS POLYMER SUPPORTS FOR ORGANIC SYNTHESIS Final Report, 1 Sep. 1982 - 30 Nov. 1985
Warren T. Ford 28 Feb. 1986 9 p
(Contract DAAG29-82-K-0133)
(AD-A165749; ARO-19156.9-CH) Avail: NTIS HC A02/MF A01 CSCL 11/9

Highly cross-linked macroporous polystyrenes and microporous polystyrenes have been used as supports for Wittig reagents and for ester precursors to medium and large ring lactones and Beta-keto esters. Functionalization of the polymer with the bulky lithium dipehnylphosphide allows subsequent high yield Wittig reactions even with large aldehydes to form vitamin A derivatives and with large ketones such as a 3-keto steroid on a 20% cross-linked macroporous support. Reduced mobility of the polymer-supported reagent compared with a soluble analog enabled cyclization of 12-hydroxydodecanoic thiol ester in higher yield in the polymer than in solution at similarly high concentration. C-13 NMR spectral analysis was developed into a routine tool for analysis of insoluble polymer-supported reagents. The glass-to-gel transition temperatures of polymer-supported reagents were shown to be much lower than the temperatures at which useful syntheses are carried out. A new, safe, low-cost method for preparation of chloromethylated polystyrenes by phase transfer catalyzed chlorination of poly(p-methylstyrene) was discovered. GRA

N86-28201# Case Western Reserve Univ., Cleveland, Ohio.
THE EFFECTS OF MECHANICAL DEFORMATION ON SORPTION AND DIFFUSION IN POLYMERS Final Report, 1 Sep. 1982 - 31 Dec. 1985
C. E. Rogers 24 Feb. 1986 8 p
(Contract DAAG29-82-K-0172)
(AD-A165762; ARO-19240.2-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

This research was concerned with determination of the effects of static tensile and cyclic tensile (fatigue) mechanical deformations on the sorption, diffusion, and permeation of selected gases, vapors, and liquids in representative elastometers, glassy polymers, and semicrystalline polymers. The project also considered apparent effects of the sorbed and diffusing penetrant on polymer structure in so far as those effects lead to concurrent changes in sorption and transport behavior. The polymers chosen for this study were: blends of different modulus silicone rubber, synthetic natural rubber, biaxially oriented polystyrene, bisphenol-A-polycarbonate, polyethylene, polypropylene and polybutene-1. The penetrant gases, vapors, or liquids were: helium, nitrogen, argon, carbon dioxide, methanol, acetone, benzene, and dichloropentane. Not all penetrants were used with all polymer samples; the penetrant was selected for each experiment on the basis of the information desired. GRA

N86-28202# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
RESIDUAL STRESS MEASUREMENTS OF A PLASMA SPRAYED COATING SYSTEM USING SYNCHROTRON X-RAY RADIATION
P. Georgiopoulos, J. B. Cohen, and H. Herman Feb. 1986 11 p
(Contract N00014-80-C-0116)
(AD-A165785; AD-E900554; TR-23) Avail: NTIS HC A02/MF A01 CSCL 11/3

Residual stresses have been measured for the first time in the substrate below a plasma coating of ceramic. The effect of the heating by the coating during application was detected. GRA

N86-28203# Brookhaven National Lab., Upton, N. Y.
NEUTRON SCATTERING STUDIES OF MAGNETIC CORRELATIONS IN REENTRANT SPIN GLASSES
S. M. Shapiro, G. Aeppli (Bell Telephone Labs., Inc., Murray Hill, N. J.), H. Maletta (Kernforschungsanlage, Juelich, West Germany), and K. Motoya (Sala Magnetics, Inc., Cambridge, Mass.) 1985 27 p Presented at the Cliff Shull Ceremonial Conference, Cambridge, Mass., 24 Sep. 1985
(Contract DE-AC02-76CH-00016)
(DE86-005244; BNL-37352; CONF-8509185-2) Avail: NTIS HC A03/MF A01

We review neutron scattering measurements performed on

two disparate reentrant spin glass systems: the magnetic insulator Eu(sub x)Sr(sub 1-x)S and the metallic alloy Fe(sub 1-x)Al(sub x). We show that the magnetic behavior in the two is very similar and can be explained in terms of random field effects which arise when ferromagnetic and spin glass order parameters are coupled together. DOE

N86-28204# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
MECHANISM OF MECHANICAL FATIGUE OF FUSED SILICA Progress Report, Jul. 1 - 31 Dec. 1985
M. Tomozawa Jan. 1986 16 p
(Contract DE-FG02-85ER-45217)
(DE86-005503; DOE/ER-45217/1) Avail: NTIS HC A02/MF A01

The mechanical strength of glass is strongly influenced by crack geometry. In particular, the mechanism of mechanical fatigue of glasses is closely related to crack tip geometry and a different mechanism has to be invoked depending upon whether the crack tip is sharp or blunt; a sharp tip crack can simply propagate, but a blunt tip crack has to be sharpened before it can propagate. In order to investigate the possibility of a blunt crack tip, the following two experiments were conducted: (1) strengthening upon annealing of glasses with extended crack; and (2) kinetics of strength increase upon annealing in various atmospheres. From the results of these experiments, it was shown that the crack tip of glass becomes blunt upon annealing. The results suggest that the mechanical fatigue of some glasses involves crack initiation as well as crack growth. DOE

N86-28205# Lehigh Univ., Bethlehem, Pa.
ANALYTICAL ELECTRON MICROSCOPY STUDIES OF PRECIPITATION IN CERAMIC SYSTEMS
1986 57 p
(Contract DE-FG02-84ER-45150)
(DE86-005511; DOE/ER-45150/1) Avail: NTIS HC A04/MF A01

The purpose of the proposed research is to gain an understanding of precipitation and solid state phase transformations in ceramic systems with potential for improvement in properties through transformation toughening. AEM (analytical electron microscopy), CBED (convergent beam electron diffraction), and HREM (high resolution electron microscopy) are used as the major research techniques. During the next grant period it is proposed to continue investigation on the ZrO2-TiO2-MgO ternary system, and to perform research concerning interfacial structure and microchemistry in zirconia-based eutectic systems. In addition, work performed during the present research year (1985 to 1986) is described, including completed research on precipitation in the Y2O3-La2O3 system. DOE

N86-28206# Argonne National Lab., Ill.
MIXED ALKALI EFFECT IN SODIUM RUBIDIUM GERMANATE GLASSES
J. N. Mundy and G. L. Jin 1985 11 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract W-31-109-eng-38)
(DE86-005553; CONF-851217-34) Avail: NTIS HC A02/MF A01

The lack of general applicability of the many theoretical models for the mixed alkali effect (MAE) in glasses is briefly reviewed. Although the MAE appears to be related to the bonding affinity of alkali ions to charge compensating centers in the glass network, experimental scatter and the difficulty of comparing different glass networks have prevented systematic tests of this relationship. The present paper discussed why the mixed alkali germanate glasses should provide a glass system where the concentration and strength of charge-compensating centers can be systematically varied and the relationship to the MAE tested. Such tests are only possible if the ionic conductivity of a series of mixed alkali germanate glasses can be measured in a reproducible manner. The measurements of the ionic conductivity of two series of X(Na,Rb) O:(1-X)GeO glasses, with X = 0.19 and X = 0.29, respectively, suggest the necessary reproducibility can be attained. DOE

N86-28207# Stanford Linear Accelerator Center, Calif.
PROPERTIES OF THIN ANTI-MULTIPACTOR COATINGS FOR KLYSTRON WINDOWS
A. R. Nyaiesh, E. L. Garwin, F. K. King, and R. E. Kirby Aug. 1985 18 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract DE-AC03-76SF-00515)
(DE86-005661; SLAC-PUB-3760; CONF-851174-28) Avail: NTIS HC A02/MF A01

Low secondary electron emission yield (1 to 1.3), low RF-loss films are of interest as coatings for alumina ceramic high power klystron windows. Air-oxidized Cr films offer an alternative to TiN. This work shows that they have the required resistivity for low RF-loss, combined with stability in the secondary electron emission (SEE) yield under bakeout and electron bombardment. SEE, AES, XPS, ELS, oxidation, bakeout and electron bombardment results are presented for Cr and TiN layers deposited by sputtering onto high density alumina substrates. The surface of TiN oxidized to a 9A thick TiO2 layer which, under bakeout to 550C in vacuum, thinned to 6A. This extreme layer-thinness resulted in a significant drop in the SEE yield which, unfortunately, was reversible upon re-oxidation. The oxidized layer on Cr was 17A of Cr2O3 which thinned to 13A upon bakeout. This thicker oxide layer produced a stable SEE yield which, although not as low as oxidized TiN, is sufficient to prevent electron multipactor. Windows covered by air-oxidized Cr films are at least as good, under tube processing conditions as the best TiN coated windows. DOE

N86-28208# Los Alamos National Lab., N. Mex.
LOAD-RATE CHARACTERISTICS OF CERTAIN POLYURETHANE FOAMS
E. G. Endebrock Nov. 1985 20 p
(Contract W-7405-eng-36)
(DE86-005863; LA-10567-MS) Avail: NTIS HC A02/MF A01

Three urethane foams were subjected to quasistatic and drop tests to evaluate their mechanical properties under various loading rates. The foam formulations, tests, and data reduction procedures are described and test results are presented and discussed. All of the foams are load-rate sensitive and have large energy absorbing capacities when loaded beyond their yield stresses. DOE

N86-28209# Sandia National Labs., Albuquerque, N. Mex.
TFTR LIMITER STUDY: COATING ADHESION TESTING AND GRAPHITE SURFACE PREPARATION
A. W. Mullendore and J. F. Smatana Nov. 1985 13 p
(Contract DE-AC04-76DP-00789)
(DE86-004186; SAND-85-1514) Avail: NTIS HC A02/MF A01

A pull-rod adhesion test was used to evaluate the bonding of chemical vapor deposited coatings of TiC and TiB on POCO AXF5Q graphite. The samples were from two different coating suppliers. They were tested in the as-deposited, 2000 C annealed and electron beam thermally cycled conditions. All of the substrates were ultrasonically cleaned before coating. All samples (except the tests where the pull-rod adhesive failed) exhibited fracture in the graphite substrate, while no coating/substrate separations were observed. Since proper substrate preparation appears to assure good bonding, a detailed study of an ultrasonic cleaning sequence was made, with characterization of the surface after each step. The quality of the preparation is clearly revealed by visual appearance, an adhesive tape stripping test, and by SEM micrographs of the surface. DOE

N86-28210# Societe Nationale Industrielle Aerospatiale, Paris (France).
CERAMIC-CERAMIC COMPOSITES
Hordonneau and Capdepuy 1986 8 p In FRENCH; ENGLISH summary Presented at 1st European Conf. on Composite Materiaux, Bordeaux, France, 24-27 Sep. 1985
(SNIAS-861-430-102; ESA-86-97164) Avail: NTIS HC A02/MF A01

Ceramic-ceramic composites were manufactured to verify theoretical conclusions and to confirm their potential interest in

the aerospace industry. The tested materials include silica matrix composites with short (SIC) or long fibers (SIC and Nextel). The matrix is obtained by successive drying-firing cycles of silica sol layers. Unidirectional alumina-alumina composites were used to test the effect of a reduced fiber-matrix adherence. The results confirm the interest in these materials and show the need to control the fiber-matrix interface and to increase the fiber's thermal stability. ESA

N86-28211# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
ELECTROACTIVE POLYMERS
Anders Wirsen Jan. 1986 80 p Partly in ENGLISH and SWEDISH
(FOA-C-20596-F9; ISSN-0347-3694; ESA-86-97036) Avail: NTIS HC A05/MF A01

Polymer electromagnetic interference (EMI) shielding, batteries for vehicles, and hydrophones are discussed. As filling material for EMI shielding polymers, iron and carbon are used. Polymeric batteries can be charged in a much shorter time than lead batteries. Documentation on EMI shielding, signature material, doping, organic electroconduction material, covalent conductive polymers, and piezoelectric polymers for hydrophone applications is given. ESA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-28212# Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.
THE 22ND JANNAF COMBUSTION MEETING, VOLUME 1
Debra Sue Eggleston, ed. Oct. 1985 561 p Meeting held in Pasadena, Calif., 7-10 Oct. 1985
(Contract N00024-85-C-5301)
(AD-A165503; CPIA-Publ-432-Vol-1) Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Several topics related to rocket and gun propellants, rocket motors and engines, and combustion processes are discussed. Metal combustion|steady state combustion, ignition and temperature sensitivity, combustion stability, ramjet combustion, supersonic combustion, and nitramine combustion are among the topics covered. For individual titles, see N86-28213 through N86-28258.

N86-28213# Atlantic Research Corp., Alexandria, Va.
EFFECTS OF OXIDIZER DEPLETION ON BORON CLOUD COMBUSTION TIME c25
Merrill K. King *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 1-11 (For primary document see N86-28212 19-28)
(Contract F49260-81-C-0035)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

An examination of the effects of oxidizer depletion on boron particle burn times in dust clouds has been carried out. A detailed boron combustion model allowing for finite-rate kinetics of surface reactions has been used to develop an expression for the burning rate of boron particles as a function of such parameters as pressure, particle size, temperature, and instantaneous concentration of oxidants in the gases around the particle. This expression has then been coupled with mass conservation equations for boron and the oxidants in the dust cloud, and the resulting set of differential equations describing the time rates of change of particle size and oxidant concentration has been integrated to particle burnout to determine the particle burn time for given initial particle size, pressure, and initial cloud oxidation index. As expected, combinations of large particle size and high pressure lead to curves duplicating those calculated using a diffusion-limited closed-form expression from the literature, while combinations of small size and low pressure result in curves duplicating those calculated using a kinetics-limited closed-form expression. Intermediate curves are presented for various pressure and initial particle sizes, and effects of these parameters on the location of these curves relative to the two limiting-case curves are discussed. Author

N86-28214# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
LASER-INDUCED FLUORESCENCE IMAGING OF SOLID PROPELLANT FLAMES c20
T. Edwards, D. P. Weaver, S. Hulsizer (Dayton Univ. Research Inst., Edwards AFB, Calif.), and D. H. Campbell *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 13-20 Previously announced in IAA as A86-19800 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The application of several systems to detect and analyze laser-induced fluorescence (LIF) in solid propellant flames is described. Propellant flames are a difficult diagnostic environment for LIF because of the large amount of light scattered from particulates in the flame. This scattering must be separated from the fluorescence to obtain meaningful results, a separation that is best accomplished with a multiple stage spectrometer. The influence on fluorescent intensity of propellant type, pressure, and position in the flame have been studied, with the increasing optical density of the propellant flame with increasing pressure looming as one of the major difficulties with high pressure propellant diagnostics. 2-D imaging of the fluorescence is difficult because the filtering necessary to separate the fluorescence from the scattered light destroys the two-dimensional nature of the flame image. Author

N86-28215# Dayton Univ., Ohio. UDRI Fluid Mechanics.
OPTICAL CONSIDERATIONS IN OBTAINING A STATISTICAL DATA BASE ON PROPELLANT DEFLAGRATION c20
R. J. Becker and J. L. Laird *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 21-28 (For primary document see N86-28212 19-28)
(Contract F04611-83-K-0023)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The utility of copper-vapor laser illumination for high-resolution, high-speed cinephotography of solid-propellant deflagration was demonstrated. Movies can be made with a ratio of the field dimension to the smallest resolvable size of greater than 300. These movies are unimpaired by flame brightness, motion blur, or laser speckle. At pressures below 250 psi, particles appear in a size range (50 to 200 microns) that does not occur in the original formulation. The performance of the experiment is critically dependent on the combined Modulation Transfer Function of the camera lens and film. Since the depth-of-field and resolution are coupled, high resolution exacts a penalty of a severely limited depth-of-field. The use of white-light illumination has placed severe constraints on the depth-of-field and field-of-view that can be obtained from such films at high resolution. The use of an intense pulsed laser for illumination relaxes these constraints. Consequently, it is now possible to survey an entire strand surface in detail. In this manner, meaningful statistical information can be obtained about particular behavior in the flame. In particular, analyses of interactions between particles and cooperative behavior, if any, can be made. Author

N86-28216*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EROSIVE BURNING RESEARCH c25
L. Strand, L. Yang, R. Ray, and J. Barry *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 29-40 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The preliminary results are presented for the completed tests in a series of motor firings being carried out to measure the transition length threshold conditions (axial position at which deviation from non-erosive burning rate begins) while attempting

to systematically vary the parameters that are considered to control the phenomenon. The erosive-burning predictions determined from a supporting ballistics analysis are also presented. Author

N86-28217# Georgia Inst. of Tech., Atlanta.
FURTHER RESULTS ON THE COMBUSTION BEHAVIOR OF AP/POLYMER SANDWICHES WITH ADDITIVES
E. W. Price, J. K. Sambamurthi, and R. K. Sigman *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 41-54 Sponsored in part by Office of Naval Research and Air Force Office of Scientific Research (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Results are reported on the combustion behavior of AP-PBAN binder sandwiches in which various additives are included in the binder lamina. A screening study reports results with 10% additive in 50 m thick binder lamina tested at 3.5 MPa (500 psi). Fe2O3 was chosen for more detailed study using a range of thicknesses of binder lamina, additive loading and test pressure. The screening study included both burning rate enhancers and burning rate depressants. In the case of Fe2O3, the combined results indicate that concentration of the catalyst on the binder surface leads to near-surface breakdown of heavy fuel molecules, which leads to closer approach to the O-F flame to the surface and corresponding increase in burning rate. The results indicate that condensed phase or surface reactions of the AP are not catalyzed and that condensed phase AP-binder interaction is not catalyzed. However, closer proximity of the O-F flame does increase the AP self deflagration rate, thereby increasing sample buring rate. Copper chromite seems to act in the same manner as Fe2O3. The other additives appear to act in a variety of ways, which need further study to clarify. Surface concentration on the binder laminae was conspicuous with Fe2O3 copper chromite, and iron blue (catalysts), and with aluminum hydroxide (suppressant). Surface concentration was minimal with copper oxide (catalyst) and antimony oxide (suppressant). Author

N86-28218# Army Armament Munitions and Chemical Command, Dover, N.J.
SINGLE-SHOT H2 CARS SPECTROMETRY OF PROPELLANT IGNITION AND COMBUSTION, UNDER PRESSURE c25
T. E. Haw (Geo-Centers, Inc., Newton, Mass.), S. Darrah, and L. E. Harris *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 55-64 (For primary document see N86-28212 19-28)
(Contracts DAAK10-81-C-0265; DAAA21-85-C-0139)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A single-shot H2 coherent anti-stokes Raman spectroscopy (CARS) spectrometer has been developed and experimental considerations for accurate thermometry examined. The spectrometer is capable of synchronization with external events such as laser-initiated propellant ignition or ballistic compression, given an inherent delay time of 250 microseconds and a predetermined diagnostic time window approaching 1 second. Additional capability to operate in a double Q-switched mode (two diagnostic probes 60 to 90 microseconds apart) has been demonstrated, with inherent delay time of 190 microseconds. Application to static samples of H2 and to H2/O2 flame reveal unreferenced errors approaching 10% or more in temperature determination, and indicate the necessity for simultaneous standardization in accurate thermometry. Concentration determination in an unreferenced fashion reveals errors of 30%, with contributions from YAG and dye laser intensity and phase fluctuations. Q-branch lines from the first vibrational state of hydrogen have been observed for the first time in the H2/O2 flame using this apparatus. These observations have been incorporated into more accurate spectroscopic constants for use in computer modeling, and concur with ab initio results and recent spectral determination in hydrogen discharge. A parallel reference system has been implemented in the apparatus, and performance evaluation begun in single-pulse extraction experiments with the laser running at 10 Hz. Author

N86-28219# Morton Thiokol, Brigham City, Utah.
ROCKET PROPELLANT IGNITION: A WORKSHOP REPORT c25
M. Salita *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 65-86 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

An all-day workshop on rocket propellant ignition was held October 2, 1984 at the 21st JANNAF Combustion Meeting, with thirty-one attendees representing numerous government facilities, industrial corporations, and universities. The morning session consisted of prepared viewgraph presentations, while the afternoon consisted of discussion and an attempt to develop a consensus about the required elements of ignition modeling. The main goal of the workshop was to aid modelers in choosing the best techniques for motor ignition prediction. Although general modeling criteria were established by consensus, time was insufficient to identify optimum specific models. The purpose is to document the consensus criteria, and to summarize the many useful overviews of ignition modeling presented by the experts in the field. Author

N86-28220# Atlantic Research Corp., Gainesville, Va. Ignition Tech. Internal Research and Development.
A ROCKET MOTOR IGNITION MODEL UTILIZING IGNITION DELAY VERSUS PRESSURIZATION RATE DATA c25
J. E. Wills *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 87-96 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A lumped-parameter, dual-chamber rocket motor ignition model used to predict the ignition transient of end burners, space motors, or low port length to port diameter ratio (L/D) motor configurations is presented. The analysis models the ignition transient in a pyrogen type igniter and motor combustion chamber independently using the isentropic nozzle flow equations to couple the two solutions. The model is also applicable to bag type igniters by setting the igniter pressure and temperature equal to the combustion chamber pressure and temperature. The computer solution continuously monitors ignition delay versus pressurization rate data obtained from actual rocket motor firings to determine the point of motor ignition based on the calculated average pressurization rate. The model correctly predicts the chamber pressurization rate and, thus, the motor ignition delay given thermochemistry, geometry, and burning rate data for the igniter charge and rocket motor grain. Author

N86-28221# Cohen (Norman S.) Professional Services, Inc., Redlands, Calif.
ANALYTICAL MODELS OF COMBUSTION RESPONSE FUNCTIONS c25
Norman S. Cohen *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 97-102 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The objective was to relate analytical models of combustion response functions to available information about the combustion process of composite solid propellants. It has been acknowledged that ignorance about the combustion response to pressure and flow perturbations is the most limiting aspect of efforts to deal with solid rocket motor combustion instability. Analytical models have been developed to calculate combustion response, but they have proven to be deficient in a number of respects. It was considered that information about the structure of the combustion zone has become available which are not embraced by the current models, and there is concern about continued model developments which do not account for them. There needs to be more interchange and coordination between the modeling work and the generation of phenomenological information in order to identify the limitations of the models and the most important direction for future efforts. Author

N86-28222# Georgia Inst. of Tech., Atlanta.
NONLINEAR COMBUSTION INSTABILITY c25

G. A. Flandro *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 103-112 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The Nonlinear Combustion Instability Workshop was held in conjunction with the 21st JANNAF Combustion Meeting at the Johns Hopkins Applied Physics Laboratory from 30 September to 1 October 1984. The areas of discussion were selected from a list of issues left unresolved by the 1974 Nonlinear Instability Workshop. The discussions covered: (1) nonlinear behavior from the perspective of recent experimental programs and motor development experience, (2) basic nomenclature and definitions pertaining to nonlinear phenomena, (3) status of analytical models and their limits of applicability, and (4) current understanding of the physical mechanisms of nonlinear instability. Author

N86-28223# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
DRIVING OF AXIAL OSCILLATIONS BY SIMULATED SOLID PROPELLANT FLAMES **c20**
S. V. Sankar, J. I. Jagoda, B. R. Daniel, and B. T. Zinn *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 113-121 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0082-84)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

An experimental setup has been developed to simulate oscillatory solid propellant flames. High speed Schlieren/shadowgraph cine photography capabilities have been developed and used to study the experimental flames under different oscillatory flow conditions. These showed that away from a pressure minimum the flat flame oscillates undistorted relative to the side wall surface while at a pressure minimum the flame is distorted by flamelets which form near its center and grow as they are convected along its surface. Also, capabilities for measuring C-H and C-C radiation from the oscillatory flame have been developed and used. The phase differences between radiation and pressure oscillations have been determined and are reported. These phase differences are such that Rayleigh's criterion for driving acoustic waves is satisfied in regions away from acoustic pressure minima. Author

N86-28224# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
A NUMERICAL MODEL FOR THE RIJKE BURNER **c25**
R. L. Raun and M. W. Beckstead *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 123-131 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0157-83)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Combustion instability often adversely effects the performance of solid propellant rocket motors. Various particulate suppressants have been added to rocket propellants to damp acoustic oscillations, but results are unpredictable and often unsatisfactory. A basic theory of how particulate suppressants function needs to be developed. The effects of particle combustion on acoustic oscillations have been studied by Braithewaite, et. al. in a Rijke burner. Past mathematical models for the Rijke tube did not consider heat loss or particle effects, both important in the Rijke burner. As a result, past Rijke tube models are inadequate for modelling the Rijke burner. A new numerical model for the Rijke burner has been developed to account for the effects of varying temperature (heat loss) and particles. The objective of this model is prediction of characteristic frequencies and growth rates for oscillations in a Rijke burner. The model has been compared to several analytical test cases and gives good results, typically within 1% for frequency and 6% for growth rate. Past flame response models of Bailey and Merk have been tested with the model and are found to fit experimental data reasonably well (within 7% for frequency and 25% for growth rate) when heat loss is taken into account. A modification of Bailey's model which includes a time lag can be used to fit experimental data exactly. Preliminary results with particle combustion indicate qualitative agreement with experiment and that more work is required to obtain quantitative agreement. Author

N86-28225# Naval Weapons Center, China Lake, Calif.
ANALYSIS OF LONGITUDINAL CHAMBER PRESSURE OSCILLATIONS IN SHUTTLE SRB'S DURING FLIGHT **c20**
H. B. Mathes and C. J. Bicker *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 133-138 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Magnetic tapes containing digitized chamber pressure data from four Space Shuttle Solid Rocket Booster Motors (SRB's) were received from Shuttle flights STS-9, -11, and -41D. Analysis of the flight data indicates presence of mild longitudinal chamber pressure oscillations similar to those found in static tests of SRB's. Details of data from flight motors are presented and a comparison of amplitudes between flight motors and statistically tested motors is made. With one exception, chamber pressure amplitudes in flight motors are lower than those found in statistically tested motors. Author

N86-28226# Georgia Inst. of Tech., Atlanta.
ENERGY BALANCE ANALYSIS OF VORTEX DRIVEN OSCILLATIONS **c20**
G. A. Flandro *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 139-149 (For primary document see N86-28212 19-28)
(Contract F04611-83-C-0003)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Several mechanisms by which hydrodynamic instability of sheared regions of flow in a rocket chamber drive acoustical oscillations are integrated in this analysis into a comprehensive model of the vortex shedding phenomenon. The energy method is utilized to enable extension of the linear theory evaluated herein to finite amplitude problems in which nonlinear effects are likely to be dominant. A detailed model of the feedback effect which links the acoustical and vortical fields in the vicinity of the shear layer origin is presented. This is a vital element in the modeling since it provides the phasing and also the strength of the vortical waves relative to the superposed acoustic field. The most important mechanism involved in the transfer of vortical energy into the acoustic field is shown to be the interaction of the vortices with a solid surface of impingement at a suitable distance and location downstream from the shear layer origin. The energy transfer in this case is equivalent to a dipole sound source; a far more efficient mechanism than the volume quadrapole effects that have previously been evaluated. Two useful motor design tools emerge. The first is a simple rule by which designers can make the changes in internal ballistics necessary to eliminate or reduce vortex driven oscillations. The second is a growth rate model that allows a quantitative assessment of vortical interactions which is compatible with the standard stability assessment procedures in wide-spread use. Author

N86-28227# United Technologies Corp., San Jose, Calif.
COUPLING BETWEEN VELOCITY OSCILLATIONS AND SOLID PROPELLANT COMBUSTION **c25**
R. S. Brown, A. M. Blackner, P. G. Willoughby, and R. Dunlap *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 151-160 Previously announced in IAA as A86-19933 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Cold flow studies are being conducted to define and characterize the basic flow field and heat transfer mechanisms controlling the coupling between the acoustic velocity and the solid propellant combustion zone. This coupling produces a substantial effect on the overall acoustic energy balance in the combustion chamber, yet significant deficiencies exist in the current basic knowledge regarding this coupling. Previously reported measurements of the oscillatory heat transfer have demonstrated that the current heuristic for velocity coupling, which is incorporated in the Standard Stability Prediction Program, has series deficiencies. These data also suggest the acoustic velocity behaves much

differently than the classical longitudinal acoustic waves assumed in the model. Therefore, current studies are focusing on measuring the characteristics of the acoustic environment in more detail. Split film anemometer measurements have been made to determine the acoustic velocity vector under several flow and acoustic conditions. The results show that regions of highly oscillatory rotational flows are generated near the wall and are responsible for the large variations in the magnitude of the acoustic velocity with radius. Modifications to the multidimensional combustion stability analysis have been derived to account for these vorticity contributions. Author

N86-28228# California Inst. of Tech., Pasadena.
COUPLED VORTEX SHEDDING AND ACOUSTIC RESONANCES IN A DUCT c71
K. M. Aaron and F. E. C. Culick *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting Oct. 1985 p 161-171 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0286-84)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Undesirable sound generation in the combustion chambers of solid propellant rocket motors previously has been attributed to vortex shedding from obstructions that are uncovered as the propellant burns back. An experimental investigation of the phenomenon has re-confirmed this observation and extended the unoerstanding of the mechanism by which the process is self-sustaining. A pair of aluminum baffles within a lucite duct through which air is drawn models the important aspects which enable the sound generation mechanism to operate. The baffles form an edgetone system which interacts with longitudinal acoustic modes of the chamber. Pure acoustic tones occur spontaneously, at frequencies equal to the acoustic resonances, when the spacing between the baffles satisfies certain criteria. Flow visualization using smoke and a strobe light triggered by the pressure oscillation indicates that vortex shedding occurs at the upstream baffle in phase with the acoustic velocity oscillation there. Based on the results of the present experiments and others reported in the literature, a mechanism is postulated which explains the observed behavior. It is suggested that pressures induced on the downstream baffle by the vortices convected past by the freestream drive the acoustic resonance. In turn, the acoustic velocity at the upstream baffle serves as the perturbation triggering the formation of vortices in the shear layer growing from the separation point at that location. Author

N86-28229# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANALYSIS OF HAN-BASED LIQUID MONOPROPELLANTS BY TITRATION
Madelyn M. Decker and Eli Freedman *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 173-176 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Stability studies of liquid monopropellants require analytical methods to determine the purity of each component and the composition of the whole mixture after formulation. The composition of hydroxylammonium nitrate (HAN)-based monopropellants can be determined by acid-base titrations, using either visual or potentiometric methods for the end-point determination. Titrations of mixtures of HAN and triethanolammonium nitrate (TEAN) with alcoholic potassium hydroxide or tetrabutylammonium hydroxide are feasible. This method may also be used to determine the purity of HAN. Analysis of HAN in the presence of TEAN is also possible by oxidation-reduction titration. However, the environment must be carefully controlled to ensure that the desired redox reaction is the only one occurring. Data on permanganate titrations are presented. Both methods are compared and other titrants and oxidation-reduction reactions considered. Author

N86-28230# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRANSITION METAL REACTIONS IN HAN-BASED MONOPROPELLANTS
Madelyn M. Decker, Eli Freedman, J. Richard Ward (Army Armament, Munitions and Chemical Command, Aberdeen Proving Ground, Md.), Pascal A. Tarantino, and Paul M. Davis *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 177-184 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Tests have shown that the stability of Hydroxylammonium Nitrate (HAN) based liquid monopropellants is adversely affected by the presence of transition metal ions. Atomic absorption spectroscopy, UV/visible spectroscopy and polarography are used to detect trace quantities of these metals in hydroxylammonium nitrate. Compatability studies involving HAN and selected transition metals are monitored by atomic absorption spectroscopy. Data are presented on the removal of copper and iron from concentrated hydroxylammonium nitrate solutions. Complexing agents cupferron, EDTA, DCTA, 2,2'-dipyridyl and tributylphosphate were evaluated and the effectiveness of ion exchange and adsorption resins was investigated. The stability of the iron complex formed with 2,2'depyridyl in HAN was examined. Author

N86-28231# Princeton Combustion Research Labs., Inc., Monmouth Junction, N.J.
THERMAL DECOMPOSITION STUDIES OF HAN-BASED LIQUID MONOPROPELLANTS
Neale A. Messina and Nathan Klein (Ballistic Research Labs., Aberdeen Proving Ground, Md.) *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 185-192 (For primary document see N86-28212 19-28)
(Contract DAAD05-84-M-Q118)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Thermal initiation and combustion experiments were conducted on the liquid gun propellant LGP 1845 to determine the effects, if any, of various additives. Ions of the transition metals, iron and copper, known to adversely affect storage stability of the propellant, have no effect on either reaction initiation or on gas evolution. The copper complexing agent, cupferron, in moderate concentration (approx. less than 3000 ppm) has no effect on propellant performance other than to form a pale, yellow-orange precipitate. The complexing agent 2,2'-bipyridine (dipy) tends to raise reaction initiation temperature without adversely affecting gas evolution rates, a desirable feature. Since dipy also disrupts the ability of Fe 3 to catalyze propellant decomposition, it should seriously be considered as an additive that improves propellant properties. Finally, the effect of carbon monoxide on LGP 1845 initiation and combustion was studied. The effects observed will aid in development of a more complete reaction mechanism for this material. Author

N86-28232# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MECHANISM OF THE PLASMA IGNITION PROCESS IN LIQUID PROPELLANTS
Nathan Klein, F. B. Carleton (Imperial Coll. of Science and Technology, London, England), G. Cheriyan, and F. J. Weinberg *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 201-207 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

In the course of investigating the ignition of liquid propellants by electrically initiated plasma discharges, it became clear that a number of complex and important processes were taking place within the reaction chamber, commonly called a plasma plug. The development of transparent plugs that permit optical access to the reaction chamber is described. The optical and electronic systems for high speed cine schlieren, shadow, and direct photography of events taking place within the cavity are also described. Observations are presented and briefly discussed that demonstrate the power and versatility of the equipment developed. Author

N86-28233# Applied Combustion Technology, Inc., Orlando, Fla.
ANALYSIS OF TWO-PHASE IGNITER FLOW THROUGH A GRANULAR BED **c25**
A. Michael Varney, John Martino, Saeed Ghandeharioun, Bryan Steury, and Charles Irish (Naval Ordnance Station, Indian Head, Md.) *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 209-221 (For primary document see N86-28212 19-28)
(Contract N00174-83-C-0254)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A model to characterize a pyrotechnic igniter stream flowing through a stationary packed bed of inert propellant simulant has been developed. Unsteady grain heating resulting from a convectively driven igniter stream is predicted, including the effects of vapor phase condensation and condensed phase depletion from the primary stream. Using an assumed ignition threshold criterion of an integrated energy deposition of 5 J/cm2, the model was shown to provide predictions which are in good agreement with experimental ignition effectiveness data. Theoretical results for BP, BKNO3, and MTV are presented and compared with experimental data. Author

N86-28234# Army Research and Development Command, Dover, N.J.
A STUDY OF DIFFUSION IN PROPELLANT GASES USING MOLECULAR DYNAMICS **c20**
T. Vladimiroff *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 257-262 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Sophisticated models of interior ballistics and combustion must take into account the transport properties of propellant gases. In diffusion controlled flames it is the rate of diffusion which regulates the combustion process. For interior ballistics calculations, the viscosity of the propellant gases influences the flow properties in the gun barrel. Thermal conductivity determines the heat flow to the barrel and the amount of heat conducted back to the propellant surface. Since experimental methods of measuring transport properties are difficult to perform at gun temperature and pressures, molecular dynamics was investigated as a means of calculating diffusion coefficients for propellant gases. Molecular dynamics assumes that the motion of propellant gas molecules is governed by the laws of classical mechanics. A Lennard-Jones potential is used to describe the forces between molecules. Newton's equations of motion are solved using a predictor-corrector type of algorithm for 256 particles in conjunction with a periodic boundary condition. The basic computation method is the same as in previous work; only the computer program has been modified to keep track of the distance each particle diffuses as a function of time. Diffusion coefficients for nitrogen gas are reported at temperatures of 1000 K, 2000 K and 3000 K and a density range of 0.1 to 0.9 g/cubic centimeters. Author

N86-28235# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
OBSERVATIONS OF THE COMBUSTION AND FRACTURE PHENOMENA OF SINGLE UNSLOTTED STICK PROPELLANTS
M. M. Athavale, K. C. Hsieh, W. H. Hsieh, J. M. Char, and K. K. Kuo *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 263-278 (For primary document see N86-28212 19-28)
(Contract DAAG29-83-K-0081)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Single-perforated long-stick propellants have been used in large-caliber gun systems. Flame spreading and combustion inside the perforation of a stick propellant involve many complicated processes. Pressure differential across the web causes grain deformation, which further interacts with the fluid dynamic processes inside the perforation. The propellant grain may rupture at some stage during flame spreading and combustion. It is important to determine the effect of pressurization rate, initial temperature, grain geometry, and pressure outside the slick propellant on grain fracture. In this research, theoretical analysis was performed using a coupled finite-difference and finite-element code which solves: (1) one dimensional transient flow of the gas phase, (2) transient flame spreading over the propellant surface, and (3) dynamic deformation of the axisymmetric propellant grain. Experimental investigations were conducted using a windowed test chamber. A single stick propellant was mounted in the test chamber, and the internal perforation was rapidly pressurized using either compressed nitrogen gas or combustion product gases from a driving motor. Test results indicate that the critical pressure differential for grain rupture increases monotonically with the internal pressurization rate, and under extremely rapid pressurization (approx. -70,000 MPa/sec or 10.15 x 1 million psi/sec), it could be substantially higher than that for the steady-state conditions. Recovered propellant samples showed that at low pressurization rates, longitudinal slits were formed, while at rapid pressurization (>35 MPa/sec or 5.08 x 1,000 psi/sec), the grains shattered into many small pieces. This implies that at high pressurization rates, propellant mass burning rate and chamber pressure could be affected substantially by grain fracture. Author

N86-28236# University of Southern California, Los Angeles.
A NOVEL FEEDBACK CONCEPT FOR COMBUSTION INSTABILITY IN RAMJETS **c25**
P. Roy Choudhury, Melvin Gerstein, and Reza Mojaradi *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 279-287 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0222-82)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Many dump combustors exhibit low frequency longitudinal combustion instability in the frequency range of 80 to 300 Hz. Although the exact causes of combustion instability are not known precisely, it is generally accepted that the interaction of the shock induced pressure pulsation and the coherent vortex shedding at the dump plane induces combustion instability. When the coherence of the shear layer at the dump plane is disrupted either by gasjets or by upstream protrusions the effect of combustion instability is found to be minimized. The control system suggested here is based upon the idea of disrupting the shear layer at the dump plane by means of pulsing gasjets. The control system senses the critical combination of frequency, amplitude and phase angle upstream of the combustor and actuates the gasjets at the dump plane at an appropriate combination of frequency, amplitude and phase angle to partially negate the effect of upstream pressure pulsation. Experiments in two laboratory scale two-dimensional (6.4 cm x 3.8 cm and 7.6 cm x 2.54 cm) dump combustors using premixed propane-air mixtures show the feasibility of reducing chamber pressure amplitude by such a technique. Author

N86-28237# San Diego State Univ., Calif. Dept. of Aerospace Engineering.
THE FLOWFIELD OF A SIDE-DUMP COMBUSTOR **c34**
Nagy Nosseir and Shabtay Behar *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 289-294 (For primary document see N86-28212 19-28)
(Contract N0014-84-K-0373)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Flow visualization is used to study the characteristics of the flowfield of a side-dump combustor. A two-dimensional combustor simulator, with water as the working fluid, is used in this experiment. In this configuration, two jets are introduced into the combustor through rectangular ports in the combustor's sides. The two jets impinge on each other at the plane of symmetry of the combustor. Counter-rotating vortex-pairs are generated near this plane. The axes of the vortices are parallel to the plane of symmetry of the combustor. The strength of the vortices changes periodically as they stretch along the downstream direction. The effects of changing the combustor dimensions on the generation of these vortices are investigated. Author

N86-28238*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CARS SYSTEM FOR SIMULTANEOUS MEASUREMENT OF TEMPERATURE, NITROGEN AND OXYGEN DENSITIES IN A TURBULENT FLAME c25

Olin Jarrett, Jr., Richard R. Antcliff (Systems Research Labs., Inc., Dayton, Ohio), and R. Clayton Rogers *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 295-306 (For primary document see N86-28212 19-28)

Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Simultaneous nitrogen number density, oxygen number density, and nitrogen rotational-vibrational temperature (static temperature) were measured in a flame with a Coherent Anti-Stokes Raman Scattering (CARS) instrument. The fuel jet of the subsonic coaxial diffusion burner was diluted with nitrogen (20 percent by volume) to allow temperature measurements to be made across the entire jet mixing region. The CARS system incorporated a Neodymium YAG laser, an intensified silicon photodiode array detector for nitrogen temperature and density measurements and a photomultiplier-digitizer combination for oxygen density measurements. Unequal beamsplitting was used to enhance the dynamic range of the detectors. Calculations based on a parabolized Navier-Stokes computer code were compared to the CARS measurements to assess CFD model validity. Author

N86-28239# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

FLAME DRIVING OF LONGITUDINAL INSTABILITIES IN DUMP TYPE RAMJET COMBUSTORS c20

U. G. Hedge, D. Reuter, B. R. Daniel, and B. T. Zinn *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 307-316 Previously announced in IAA as A86-19839 (For primary document see N86-28212 19-28)

(Contract N00014-84-K-0470)

Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Coaxial, dump type ramjet combustors are often prone to combustion instability problems that can seriously affect their performance. Low frequency instabilities which represent one of the most common types of instabilities encountered are discussed. In particular, the coupling between cone-like flames often encountered in dump type combustors and longitudinal acoustic fields is studied. A variety of experimental techniques, including high speed Schlieren and shadow photography, CH radiation emission and acoustic pressure measurements are used. A strong coupling between the flame response and certain acoustic natural frequencies of the experimental set up is observed. These observations shed new light on flame/acoustic mode interactions in a ramjet combustor-like environment and the limitations of current state of the art theoretical models of this phenomenon. Author

N86-28240# California Inst. of Tech., Pasadena.

NONLINEAR ANALYSIS OF PRESSURE OSCILLATIONS IN RAMJET ENGINES c20

Vigor Yang and Fred E. C. Culick *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 317-329 (For primary document see N86-28212 19-28)

(Contract N00014-84-K-0434)

Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Pressure oscillations in ramjet engines have been studied using an approximate method which treats the flow fields in the inlet and the combustor separately. The acoustic fields in the combustor are expressed as syntheses of coupled nonlinear oscillators corresponding to the acoustic modes of the chamber. The influences of the inlet flow appear in the admittance function at the inlet/combustor interface, providing the necessary boundary condition for calculation of the combustor flow. A general framework dealing with nonlinear multi-degree-of-freedom system has also been constructed to study the time evolution of each mode. Both linear and nonlinear stabilities are treated. The results obtained serve as a basis for investigating the existence and stabilities of limit cycles for acoustic modes. As a specific example, the analysis is applied to a problem of nonlinear transverse oscillations in ramjet engines. Author

N86-28241# Flow Research, Inc., Kent, Wash.

LARGE EDDY SIMULATIONS OF FLOW IN A RAMJET COMBUSTOR c20

Wen-Huei Jou and Suresh Menon *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 331-339 (For primary document see N86-28212 19-28)

(Contract N00014-84-C-0359)

Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Cold flow simulations are performed for the flow inside a ramjet combustor with dump. The objective is to develop a numerical simulation code that can be used to study the complex interaction between acoustic waves and large vortex structures in such a device. The compressible Navier-Stokes equations are solved using a MacCormack semi-implicit scheme. Beginning with a flow at rest, the flow seems to reach a state of stationary variation ten longitudinal acoustic cycles after the exit pressure is lowered to a prescribed value. Vorticity contour plots reveal that the shear layer behind the backward-facing step rolls up into large vortices. These vortices go through two pairings before being convected into the wall layer. The frequency of the vortex after the second pairing is near the range of the jet preferred mode. The unsteady component of the dilation field is chosen as a quantity that characterizes the acoustic component of the motion. Contour plots of the dilation field show that it is dominated by the quadrupole sources associated with rolled up vortices. The long-wavelength standing waves cannot be detected using this method. Examination of the two-point, two-time correlation of the pressure variations at several points in the flow field gives evidence that the long-wavelength acoustic waves close to the jet preferred mode frequency have been excited. Author

N86-28242# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.

ACOUSTIC-VORTEX INTERACTIONS IN AN IDEALIZED RAMJET COMBUSTOR c20

K. Kailasanath, J. Gardner, J. Boris, and E. Oran *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 341-350 (For primary document see N86-28212 19-28)

Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Results are presented of numerical simulations performed to isolate and study the interaction between acoustic waves and large scale coherent vortex structures in an idealized ramjet combustor. A strong coupling between the acoustic modes of the chamber and large scale vortical structures is observed. The results in the early part of the calculations are indicative of an unforced natural vortex growth at a frequency close to the acoustic frequency. With time, the acoustic modes shift the frequency of the most amplified mode into resonance with the acoustic mode. The location in space where the modes grow can also be shifted by acoustic forcing. An interesting new feature that is observed is a low frequency mode corresponding to the passage of the vortex structures through the choked exit. This results in a major alteration of the merging pattern of the vortices. Author

N86-28243# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

FLOW VISUALIZATION STUDIES OF A SOLID FUEL RAMJET COMBUSTOR USING A NEW MATERIAL-POLYAPHRONS c20

J. A. Schetz, F. Sebba, and R. H. Thomas *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 351-359 (For primary document see N86-28212 19-28)

(Contract F33615-84-C-2468)

Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A new material for water flow visualization of combustor models was developed. They are small globules of one liquid encapsulated in a thin film of another liquid and are called polyaphrons. Their size, shape, color and density can all be adjusted. Several useful formulations were developed. One of the best of these was used with success in a series of tests with a Solid Fuel Ramjet Combustor mode. This is an axial flow highly confined dump combustor. The vaned swirler has flat blades set at 35 deg producing a swirl number of 0.47. The burning of the SFRJ was simulated in three stages. A 3.5 in. diameter combustor simulated the beginning of a

burn. Remarkably, a strong recirculation region was produced under these highly confined low swirling conditions. Next, injection was added through the wall of the 3.5 in. can to simulate gaseous products of the solid fuel combustion. This strengthened somewhat the recirculation but produced a tighter vortex downstream. Temperature measurements across the exit plane gave an indication that mixing between the main and injected flows was poor. Finally, a 5.0 in. can simulated the SFRJ at the end of the burn. The greater expansion of this configuration produced a larger central recirculation zone and a peripheral zone also. Author

N86-28244# Atlantic Research Corp., Alexandria, Va.
PREDICTION OF BORON DUST CLOUD FLAME SPEEDS c20
Merrill K. King *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 361-376 (For primary document see N86-28212 19-28)
(Contract F49260-81-C-0035)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A detailed model of flame propagation in boron dust clouds including oxygen, water gas, and carbon dioxide as oxidizers has been developed. Included in this model are a detailed submodel of the ignition of boron particles involving removal of an inhibiting boric oxide coating from the particles (with competitive exothermic oxide deposition processes and endothermic removal processes occurring simultaneously) and a burning rate correlation for clean-particle combustion of the particles (subsequent to removal of the oxide coating) based on a detailed particle combustion model which includes the effects of finite-rate surface reaction kinetics. Reasonably good agreement between predictions of the model and measured flame speed has been obtained although uncertainties regarding details of the experimental work (particularly as regards radiative characteristics of the products, to which predicted flame speeds are sensitive) render this agreement somewhat inconclusive. The model has been used to examine the dependency of predicted flame speed on initial cloud temperature, initial oxygen, carbon dioxide, and water gas levels, pressure, weight fraction particles, initial particle size, initial oxide coating percentage, emissivity for radiative feedback from the post-flame zone, and Nusselt Number for transport processes between particles and surrounding gas. Author

N86-28245# University of Southern California, Los Angeles.
THE USE OF ADDITIVES TO PROMOTE THE ATOMIZATION AND COMBUSTION OF SLURRY FUELS
Melvin Gerstein and P. Roy Choudhury *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 377-382 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The evaporation and combustion of slurry fuels is inhibited by the fact that the volatile carrier evaporates leaving a large agglomerate of solid particles which burn very slowly or not at all. Previous work by the authors has shown that time controlled explosion of additives in liquid sprays can be achieved. This concept is applied to the shattering of liquid drops including those containing slurries of boron and carbon particles. Experiments are reported using benzoyl peroxide and carbamide peroxide along with theoretical calculations using these additives. The time between the ignition of the drop and the onset of disruptive burning or shattering was measured and compared with theory. Good agreement was obtained using benzoyl peroxide in cumene which was chosen to illustrate the technique. It was also shown that slurry fuels could be shattered and, in particular, that boron slurries could be shattered and that the typical green flame of burning boron could be observed. Author

N86-28246# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
IGNITION AND COMBUSTION OF ALUMINUM AND ALUMINUM/CARBON SLURRY DROPLETS c25
S. R. Turns and S.-C. Wong *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 383-398 (For primary document see N86-28212 19-28)
(Contract F33615-84-C-2410)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The ignition and combustion of aluminum and aluminum/carbon slurry fuel droplets were studied in the post-flame region of a flat-flame burner. Individual droplets having initial diameters ranging from 500 to 1100 microns were supported on silicon carbide filaments and rapidly exposed to the hot gas environment. Burner operating conditions were varied to provide oxygen mole fractions ranging from 0.10 to 0.25, and gas temperatures from 1250 to 1810 K at atmospheric pressure. Flame environments both with and without water vapor were considered. Using motion picture photography, ignition and burning times were measured, and low temperature ignition limits were determined. Both the ignition and burning processes were modeled analytically, and theoretical predictions were compared with the experimental results. Composition and morphology of the residual combustion products were determined using X-ray diffraction techniques and scanning electron microscopy, respectively. Author

N86-28247*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMBUSTION IN SUPERSONIC FLOW c25
G. Burton Northam *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 399-410 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A workshop on combustion in supersonic flow was held in conjunction with the 21st JANNAF Combustion Meeting at Laurel, Maryland on October 3 to 4 1984. The objective of the workshop was to establish the level of current understanding of supersonic combustion. The workshop was attended by approximately fifty representatives from government laboratories, engine companies, and universities. Twenty different speakers made presentations in their area of expertise during the first day of the workshop. On the second day, the presentations were discussed, deficiencies in the current understanding defined, and a list of recommended programs generated to address these deficiencies. The agenda for the workshop is given. Author

N86-28248# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC COMBUSTION OF A SILANE/METHANE MIXTURE c25
G. Burton Northam and Allen G. McLain *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 411-416 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

A test program was conducted to evaluate the ignition and combustion characteristics of a 20 volume percent silane/methane mixture using a model scramjet combustor with Mach 2 combustor entrance conditions. The test gas total temperature was varied from 1200 to 3900 R. The mixture autoignited at a total temperature of 1650 R. This autoignition temperature can be contrasted with 2330 R for hydrogen and 1350 R for a 20 percent silane/hydrogen mixture in similar hardware. Methane without the silane additive did not autoignite in this configuration at temperatures as high as 3900 R. Author

N86-28249# United Technologies Research Center, East Hartford, Conn.
CARS FEASIBILITY DEMONSTRATION IN SUPERSONIC COMBUSTING FLOWS c25
Torger J. Anderson, Ira W. Kay, and William T. Peschke *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 417-428 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The feasibility of coherent anti-Stokes Raman spectroscopy (CARS) as a diagnostic for measuring temperature and species concentrations in supersonic combusting flows has been demonstrated. The data required to determine the combustion efficiency of the flow include the fuel/air equivalance ratio of the propane/air mixture and the stagnation temperatures of the propane/air flow and the pilot product stream. The results obtained by the CARS

system were a series of single shot, instantaneous static temperature measurements made at a centerline point during the combustion process. These data, combined with static and stagnation pressure measurements can provide the total temperatures required to compute the combustion efficiency. By plotting the CARS temperature data as histograms for each point, the temperature spread can be observed, providing insight into the turbulent nature of the flow. Author

N86-28250*# Aerojet Technical Systems Co., Sacramento, Calif.
LONGITUDINAL MODE COMBUSTION INSTABILITIES OF A HIGH-PRESSURE FUEL-RICH LOX/RP-1 PREBURNER c38
J. J. Fang *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 429-441 (For primary document see N86-28212 19-28)
(Contract NAS3-22647)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

During the hot-fire testing of a high-pressure fuel-rich LOX/RP-1 preburner, longitudinal mode combustion instabilities were observed. The experimental data showing how the instability varied with the chamber pressure, mixture ratio, chamber length and turbulence ring are given. Technical rationales are given for the test-to-test hardware configuration changes that eventually led to the stable result. Author

N86-28251# Colorado State Univ., Fort Collins.
IMPROVEMENT OF AN INTEGRAL STABILITY MODEL c25
C. E. Mitchell *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 443-452 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Research directed at extending and improving on an integral, iterative predictive model for combustion instability in liquid propellant rocket engines is described. Theoretical extensions of the model to include sources of combustion distributed along the axis of the combustion chamber are presented. Modifications made to the existing computer code which are necessary for inclusion of these theoretical improvements are discussed. Finally, results of calculations made using the improved model are presented and features of its predictive capability are described. Author

N86-28252# Pratt and Whitney Aircraft, West Palm Beach, Fla. Engineering Div.
PERFORMANCE COMPARISON OF THE CURRENT SSME AND A NEW MAIN INJECTOR-MAIN COMBUSTION CHAMBER CONFIGURATION USING THE JANNAF METHODOLOGY c20
R. G. Carroll, D. R. Connell, and C. D. Limerick *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 453-462 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Increasing the specific impulse of the Space Shuttle Main Engine (SSME) by one second will increase the payload capability by approximately 1100 pounds. The specific impulse of the current SSME and a new improved SSME configuration are compared at full power level (FPL), using the rigorous JANNAF methodology. The calculated value for specific impulse for the current SSME is 450.7 seconds which compares with the accepted value of 452.8 seconds obtained from flight data. The calculated specific impulse for the improved configuration is 456.0 seconds. An improved powerhead configuration has been proposed for the SSME to increase specific impulse as well as life, maintainability and operability. The rigorous JANNAF methodology was used to calculate the specific impulse of the current SSME and the improved configuration at FPL. The JANNAF methodology is given. The improved configuration main injector has 2466 tangential entry, coaxial injection elements equally spaced along radial spraybars which extend from the outer periphery of the injector toward the centerline, like the spokes in a wheel. 52.0 cm (20.5 in.) at the injector end, and a contraction ratio of 3.58. Author

N86-28253*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
MODELING OF DENSE SPRAYS FROM LOX/H2 COAXIAL INJECTORS UNDER SUPERCRITICAL CONDITIONS c34
P. Y. Liang and R. J. Jensen *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 463-471 (For primary document see N86-28212 19-28)
(Contract NAS8-27980)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Assumptions commonly employed in the analytical description of a thin spray become unacceptable as the droplet density and droplet volume displacement become large. Changes in the semiempirical models describing drop-drop or drop-gas interactions as well as in the basic modeling approach itself may be necessary. A number of efforts undertaken to improve such models of the atomization-evaporation process to render them applicable in the dense-spray, supercritical regime are described. The improvements include those for variable drop density, supercritical properties, stripping evaporation and drop reincorporation into the liquid stream. The models are developed for use with the ARICC three-phase finite difference combustion code. Selected results from a sample calculation are presented, demonstrating the enhanced realism achievable with the upgraded models. Author

N86-28254*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
SSME FUEL PREBURNER PHASE 1/PHASE 2+ COMPARISON c20
R. J. Jensen, P. Y. Liang, and S. M. Pinkowski *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 473-476 (For primary document see N86-28212 19-28)
(Contract NAS8-27980)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

An analytical comparison of the predicted combustion flowfields for the Phase 1 and Phase 2+ fuel preburner configurations using an advanced CFD combustion code is currently underway at Rocketdyne. The Phase 2+ injector has a modified element design. The redesigned element provides for improved atomization through a shift in the injector element/face bleed flow split while maintaining an acceptable pressure drop. Cold-flow tests of the new design have been encouraging. As a complement to those tests, the Advanced Rocket Injector Combustor Code (ARICC) was selected to conduct a detailed combustion flowfield simulation. ARICC models two-dimensional (or axisymmetric), transient, turbulent, two-phase mixing and combustion flowfields. It is derived from a member of the Los Alamos ICEd-ALE family of codes. Unique features of ARICC include explicit representation of the coaxial LOX jet and hydrogen gas flows, distributed atomization processes, droplet breakup, and supercritical vaporation processes. Predictions of temperature and OH concentration profiles for the Phase 1 and Phase 2+ injector flowfields indicate a trend toward more uniform temperature distributions and shorter flame lengths with the Phase 2+ design. Author

N86-28255# Remtech, Inc., Huntsville, Ala.
BOUNDARY LAYER SIMULATOR (BLIMPJ) IMPROVEMENT c34
S. C. Praharaj *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 477-493 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Improvements made to the existing Boundary Layer Integral Matrix Procedure, Version J (BLIMPJ) are discussed. These improvements have application to high area ratio nozzle design such as those being considered on future Orbit Transfer Vehicle (OTV) engines. The heat transfer to the nozzle wall, which is affected by such variables as wall roughness, relaminarization, and the presence of particles in the flow, was investigated. The existing motor performance loss calculation for these nozzles with thick boundary layers, which is inaccurate using the JANNAF procedure coded in BLIMPJ, was modified. The wall roughness effect was modeled successfully by modification of the turbulence model, and compared against two other engineering models

giving good comparison. The relaminarization effects were modeled using the ideas of Nash-Webber, and an approximation was given to modify the turbulence model. The results were compared against the available data of Back and Cuffel giving approximate correlation between theory and measured data. The boundary layer particle effects were accounted for by an engineering approach, but no nozzle data was available for comparison. The accuracy of the nozzle performance loss calculation from thick boundary layers was improved by determining the edge of the boundary layer through an iteration procedure. The iteration used RAMP for the inviscid flowfield and BLIMPJ for the viscous flowfield. An example of the iteration procedure is given for a typical OTV nozzle with an area ratio of 1293. Author

N86-28256*# Software and Engineering Associates, Inc., Carson City, Nev.

TWO-DIMENSIONAL KINETICS COMPUTER PROGRAM FOR ORBIT TRANSFER VEHICLES c61

G. R. Nickerson and L. D. Dang *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 495-503 (For primary document see N86-28212 19-28)
(Contract NAS8-35931)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Future Orbit Transfer Vehicles (OTV) presently under consideration require rocket engines delivering a high specific impulse. This high performance can be obtained with large area ratio thrust chambers using oxygen with either hydrogen or hydrocarbon fuels. In the projected nozzles, the combustion products are expanded to low pressure and temperature levels at high Mach number, a domain which has not been experienced with existing rocket engines. In order to assist in the design and evaluation of OTV engines, modifications have recently been incorporated in the Two-Dimensional-Kinetics (TDK) computer program. These modifications include the treatment of shock waves induced by the wall curvature, and shocks which are attached to the wall. The reflection of a shock wave at the flow axis is also treated in an appropriate manner and multiple shock reflections are allowed. A Boundary Layer Module (BLM) has also been incorporated into the TDK computer program in order to provide an automated treatment of the rigorous JANNAF rocket engine performance prediction procedure. Author

N86-28257# Naval Weapons Center, China Lake, Calif.

A SIMULTANEOUS MATHEMATICAL TREATMENT OF DEFLAGRATION AND IGNITION PHENOMENA c25

C. F. Price and T. L. Boggs *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 505-513 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

Recent emphasis on the study of transient combustion and the role of gas phase kinetics in that process has refocussed efforts to better our understanding and formulation of the ignition process. Historically, the laboratory investigation of material ignitability has been correlated in terms of either the time to first detectable event (light, pyrolysis) or the time at which self-sustaining combustion is achieved (go/no-go). In the utilization of such correlations, first-event times have been expressed as a surface temperature criterion, and self-sustaining times as a minimum-energy criterion. Variously in transient pressure prediction models the material is considered totally ignited when one or the other of the criteria has been met. The former requires calculation of a transient surface temperature, while the latter involves calculation of a transient bulk temperature. Neither is adequate for all materials in all environments, and the inadequacy is most noticeable with nitramine-based materials at high heating rates and low ambient pressures. The partial differential equations describing the condensed and gas phase reactions occurring during ignition show that inert thermal conduction, as well as reactions in both phases, may all be of significance to the process. Author

N86-28258# Naval Research Lab., Washington, D. C. Chemistry Div.

KINETIC MODELING OF DIMETHYLNITRAMINE THERMAL DECOMPOSITION: A MECHANISTIC EXTRAPOLATION TO RDX DECOMPOSITION IN THE GAS PHASE c25

M. E. Umstead, S. A. Lloyd, and M. C. Lin *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 515-521 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

The kinetics and mechanism of the thermal decomposition of dimethylnitramine have been investigated at low temperatures (466 to 524 K) in a static system and at high temperatures (800 to 1200 K) in a shock tube with IR laser and UV diagnostics. The unimolecular rate constant at the high-pressure limit was found to be K = 10 to the 15.9 power exp(-44.1/RT) s(-1). Detailed kinetic modeling has shown that the key initiation step is the dissociation of DMNA into NO2 and the dimethylamino radical, and that NO formation results mainly from the reaction of the dimethylamino radical with NO2. The more energetic steps leading to CO were found to be a series of chain reactions starting from methyl radicals. A parallel reaction scheme for the gaseous thermal decomposition of RDX is proposed. Author

N86-28259*# National Aeronautics and Space Administration, Washington, D.C.

EXPLICIT EXPRESSION TO PREDICT THE EROSIVE BURNING RATE OF SOLID PROPELLANTS

Shoufan Wang Jul. 1986 9 p Transl. into ENGLISH from Journal of Engineering Thermophysics (Beijing, China), v. 6, no. 1, Feb. 1985 p 84-86 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88465; NAS 1.15:88465) Avail: NTIS HC A02/MF A01 CSCL 21H

Using the theory of gas dynamics and heat transfer from a turbulent gas flow to the burning surface of propellant along a permeable wall, an explicit expression is derived to predict the burning rate of the solid propellant with crossflow. Results of the calculation have been compared with experimental data and proved to be correct. Author

N86-28260*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

EFFECT OF NON-NEWTONIAN ANTIMISTING KEROSENE ON JET PUMP PERFORMANCE

L. P. Bernal and V. Sarohia May 1986 48 p
(Contracts NAS7-918; DTFA03-8000215)
(NASA-CR-177192; NAS 1.26:177192; FAA/CT-85-30) Avail: NTIS HC A03/MF A01

The effect of antimisting kerosene (AMK) on jet pump performance was determined experimentally. It is shown that the performance of the jet pump is reduced by AMK as much as 50% as compared to Jet A under identical operating condition. Tests with the boost pump driven motive flow showed an improved performance. Low temperature AMK fuel resulted in an additional improvement on performance. Flow visualization and surface pressure measurements indicate suppression of turbulent mixing within the pump to be the cause for the reduced performance. In order to improve the efficiency of jet pumps with AMK, the length of the mixing chamber was increased. With increased mixing chamber length, an improvement in mass transferred rate of 15% at a 2 psi pressure head was observed. Alternatively, larger size pumps designed to operate with Jet A are also proposed. Scaling parameters are given to dimension the pump using Jet A data. Water ingestion tests showed no precipitate formation prior to the entrance to the pump. As the flow moved through the pump, large amounts of precipitate were formed. The precipitate did not impair the operation of the pump. Author

N86-28261*# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.

DETERMINATION OF SOLID MASS FRACTION IN PARTIALLY FROZEN HYDROCARBON FUELS Final Report

E. M. Cotterell, R. Mossadegh, A. J. Bruce, and C. T. Moynihan Jul. 1986 90 p
(Grant NAG3-213)

(NASA-CR-179472; NAS 1.26:179472) Avail: NTIS HC A05/MF A01 CSCL 07D

Filtration procedures alone are insufficient to determine the amounts of crystalline solid in a partially frozen hydrocarbon distillate fraction. This is due to the nature of the solidification process by which a large amount of liquid becomes entrapped within an interconnected crystalline structure. A technique has been developed to supplement filtration methods with an independent determination of the amount of liquid in the precipitate thereby revealing the actual value of mass percent crystalline solid, %S. A non-crystallizing dye is injected into the fuel and used as a tracer during the filtration. The relative concentrations of the dye in the filtrate and precipitate fractions is subsequently detected by a spectrophotometric comparison. The filtration apparatus was assembled so that the temperature of the sample is recorded immediately above the filter. Also, a second method of calculation has been established which allows significant reduction in test time while retaining acceptable accuracy of results. Data have been obtained for eight different kerosene range hydrocarbon fuels. Author

N86-28262# Mound Lab., Miamisburg, Ohio.
STUDY OF EXPLOSIVES BY DIFFUSE REFLECTANCE FT-IR SPECTROSCOPY
G. E. Hapner and A. B. Nease 1985 4 p Presented at the Joint DOD/DOE Explosives Surveillance Meeting, Albuquerque, N. Mex., 3 Dec. 1985
(Contract DE-AC04-76DP-00053)
(DE86-006111; MLM-3326(OP); CONF-851256-1) Avail: NTIS HC A02/MF A01

The infrared spectra of a number of explosives have been recorded using diffuse reflectance spectroscopy. This technique is explained. The spectra of a series of penetaerethritol tetranitrate (PETN) samples stored at elevated temperatures are used to demonstrate the usefulness of this technique. Because diffuse reflectance is surface sensitive, this technique is more sensitive to measuring changes on the surface of powered materials than transmission techniques. This advantage of diffuse reflectance spectroscopy was important in detecting spectroscopic changes in the infrared spectrum of triamino trinitrobenzene exposed to visible light. DOE

N86-28263# Lawrence Livermore National Lab., Calif.
RELATIONSHIP BETWEEN THE SHOCK SENSITIVITY AND THE SOLID PORE SIZES OF TATB POWDERS PRESSED TO VARIOUS DENSITIES
R. Lee, G. Bloom, W. VonHolle, W. Weingart, L. Erickson, S. Sanders, C. Slettevold, and R. McGuire 31 Jul. 1985 12 p Presented at the 8th International Symposium on Detonation, Albuquerque, N. Mex., 15 Jul. 1985
(Contract W-7405-eng-48)
(DE85-017266; UCRL-91827-Rev-1; CONF-850706-33-Rev-1) Avail: NTIS HC A02/MF A01

Mercury intrusion porosimetry measurements have been made on samples pressed from three different types of triaminotrinitrobenzene (TATB) powders having quite different particle size distributions. The samples had densities ranging from 74 to 99% of theoretical maximum density. Results of the porosimetry measurements are compared with shock initiation thresholds measured on the same materials. The growth of reaction in sustained pressure experiments is also compared for two of the TATB types. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-28264*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QSFC PREFERRED PARTS LISTS PPL-17
Bruno P. Baldini, ed. Sep. 1984 94 p
(NASA-TM-88769; NAS 1.15:88769) Avail: NTIS HC A05/MF A01 CSCL 13B

A listing of preferred parts, part upgrading procedures, part derating guidelines, and part screening procedures to be used in the selection, procurement, and application of parts for Goddard Space Flight Center (GSFC) space systems and ground support equipment is contained. Author

N86-28265# Department of the Navy, Washington, D. C.
METHOD OF PREPARING SINGLE CRYSTALLINE CUBIC SILICON CARBIDE LAYERS Patent
Arrigo Addamiano, inventor (to Navy) Issued 3 Dec. 1985 6 p Supersedes AD-D011305
(AD-D012191; US-Patent-4,556,436; US-Patent-Appl-SN-643327; US-Patent-Class-148-175) Avail: US Patent and Trademark Office CSCL 07/2

This invention pertains to a method of making very pure cubic silicon carbide, SiC, comprising the steps of: loading a first inner graphite cup of a Lely type furnace while cold with a large number of crystals of SiC that are used as substrates; sealing the first cup with a graphite lid; inserting the first cup into a second graphite cup and inserting them into the furnace; filling the area between the first cup and the second cup with SiC; heating the first cup to between 2300 C and 2700 C until an atmosphere saturated with Si, C, SiC2 and Si2C is created; and cooling the furnace quickly to a temperature less than 1800 C. GRA

N86-28266# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPARATUS FOR THE PREPARATION OF AIR
N. S. Nikolayev, Y. M. Itskovich, A. V. Shcherbakov, T. V. Stoyanova, and V. V. Golovin 12 Mar. 1986 10 p Transl. into ENGLISH of Russian Patent 302 279, 28 Apr. 1971 p 1-3
(AD-A165603; FTD-ID(RS)T-0134-86) Avail: NTIS HC A02/MF A01 CSCL 13/7

The invention deals with equipment for ensuring the maximal reliable operation of devices that pneumatically control air conditioning systems. It can be used, in particular, in an apparatus for preparing air for devices of pneumatic control, for example, air conditioning on aircraft. GRA

N86-28267# Army Construction Engineering Research Lab., Champaign, Ill.
INITIAL INVESTIGATION OF THREE UNCURED ELASTOMERIC ROOFING MEMBRANE MATERIALS FOR USE IN MILITARY CONSTRUCTION Final Report
Myer J. Rosenfield Feb. 1986 35 p
(AD-A165620; CERL-IR-M-86/03) Avail: NTIS HC A03/MF A01 CSCL 13/13

Three uncured elastomeric membranes were investigated as part of ongoing research into alternative roofing systems for military construction. Literature, manufacturers' data, and field applications were investigated to identify the properties and characteristics of chlorinated polyethylene (CPE), chlorosulfonated polyethylene (CSPE), and polyisobutylene (PIB), and the advantages and disadvantages associated with their use. It was concluded that Corps of Engineers use of these three materials should not be considered until an industry-wide standard for their manufacture is developed. In addition, results of future work which will test actual roofing applications should be considered before a final decision is made. Author (GRA)

N86-28268# Naval Weapons Center, China Lake, Calif.
PROCEEDINGS OF THE 10TH ANNUAL SOLDERING-MANUFACTURING SEMINAR Annual Report, Mar. 1985 - Feb. 1986
19 Feb. 1986 197 p Proceedings held at China Lake, Calif., 19-20 Feb., 1986
(AD-A165786; AD-E900554; NWC-TP-6707) Avail: NTIS HC A09/MF A01 CSCL 13/8

Presented are the proceedings of the 10th Annual Soldering/Manufacturing Seminar, held on 19 and 20 February 1986 at the Naval Weapons Center, China Lake, Calif. The proceedings include

the papers or abstracts of papers presented at the Seminar and cover all aspects of soldering technology and electronics manufacturing. GRA

N86-28269# Sandia National Labs., Albuquerque, N. Mex.
THETA GUN, A MULTISTAGE, COAXIAL, MAGNETIC INDUCTION PROJECTILE ACCELERATOR
T. J. Burgess, B. W. Duggin, and M. Cowan, Jr. Nov. 1985 80 p
(Contract DE-AC04-76DP-00789)
(DE86-004185; SAND-85-1881) Avail: NTIS HC A05/MF A01

We experimentally and theoretically studied a multistage coaxial magnetic induction projectile accelerator. We call this system a theta gun to differentiate it from other coaxial accelerator concepts such as the mass driver. We conclude that this system can theoretically attain railgun performance only for large caliber or very high injection velocity and, even then, only for long coil geometry. Our experiments with a three-stage, capacitor bank-driven accelerator are described. The experiments are modeled with a 1-1/2 dimensional equivalent circuit-hydrodynamics code which is also described. We derive an expression for the conditions of coaxial accelerator-railgun velocity breakeven in the absence of ohmic and hydrodynamic effects. This, in conjunction with an expression for the magnetic coupling coefficient, defines a set of geometric relations which the coaxial system must simultaneously satisfy. Conclusions concerning both the existence and configuration of a breakeven coaxial system follow from this requirement. The relative advantages and disadvantages of the coaxial induction projectile accelerator, previously cited in the literature, are critiqued from the viewpoint of our analysis and experimental results. We find that the advantages vis-a-vis the railgun have been overstated. DOE

N86-28270# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Dept. des Systemes Plasma Industriels.
PLASMA TORCHES
Maxime Labrot 1986 7 p In FRENCH; ENGLISH summary
Presented at Congr. on Elec. et Tech. Avancees, Bordeaux, 9-12 Oct. 1985
(SNIAS-861-430-107; ESA-86-97169) Avail: NTIS HC A02/MF A01

The characteristics and applications of high power plasma torches are described. The average enthalpy is usually < 10 MJ per kg of gas to limit electrode wear. The energy supply is normally rectified current and a series inductance is used to filter out tension fluctuations and harmonics. A high furnace process implemented with a 2 Megawatt plasma torch is detailed. ESA

N86-28271 United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
CONTROLLED REMOVAL BY ION BEAM ETCHING OF SURFACE CONTAMINANT LAYERS ON TRANSMISSION ELECTRON MICROSCOPE SPECIMENS
A. W. James Oct. 1985 17 p
(AERE-R-11796) Copyright. Avail: NTIS HC A02/MF A01

The basic principles of transmission electron microscope (TEM) specimen preparation by ion beam thinning are described. The rate of material removal from stainless steel specimens has been assessed and this information has been used to demonstrate the controlled thinning of TEM specimen. Three examples where ion beam wiping can be used to remove contaminated surface layers of TEM specimens are given: (1) chlorine - enriched surface regions on stainless steel; (2) Cu-S rich films on ferritic steels; and (3) oxide films on sintered aluminum. These examples make it clear that ion beam wiping is an essential step in the preparation of some TEM specimens where accurate chemical analysis is required. Author

N86-28290*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HVAC MODIFICATIONS AND COMPUTERIZED ENERGY ANALYSIS FOR THE OPERATIONS SUPPORT BUILDING AT THE MARS DEEP SPACE STATION AT GOLDSTONE
A. Halperin and P. Stelzmuller *In its* The Telecommunications and Data Acquisition Report 15 May 1986 12 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 13B

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-28272 British Broadcasting Corp., Kingswood (England). Engineering Div.
DIGITAL VIDEO: ASSESSMENT OF COMB-FILTER DESIGN FOR SUB-NYQUIST PAL CODECS
N. D. Wells Dec. 1985 21 p
(BBC-RD-1985/18) Avail: BBC, Kingswood Warren, Tadworth, Surrey, Engl.

One very effective technique for the bit-rate reduction of digital PAL signals is sub-Nyquist sampling. This technique requires the use of comb filters which attenuate unwanted alias components produced by the sub-sampling process and also reconstruct the color signal to standard form at the decoder. Variations are possible in the design of comb filter; in particular, the configuration can be based on line, field or picture delays. This Report outlines the theory of comb filter operation and describes the results of subjective tests which compare the performance of the different possible sub-Nyquist systems. Certain design features are also described which are required in order that sub-Nyquist codecs may be cascaded without introducing further filtering impairment after the first such codec. Author

N86-28273# Royal Signals and Radar Establishment, Malvern (England).
THE IMPLICATIONS OF BOLTZMANN-TYPE MACHINES FOR SAR DATA PROCESSING: A PRELIMINARY SURVEY
S. P. Luttrell Jun. 1985 39 p
(AD-A163749; RSRE-MEMO-3815; BR98262; ESA-86-97113)
Avail: Issuing Activity

It is proposed that Markov random field models (MRFs) be used as a framework within which to construct models of synthetic aperture radar (SAR) images. The relationship between this class of models and the Boltzmann machine (BM) of artificial intelligence is clarified. The BM training procedure is generalized and used to train MRF models. This technique is used to investigate the ability of a simple MRF texture model to learn a texture by maximizing a relative entropy objective function. The marriage of MRF models with the BM training procedure is fruitful. ESA

N86-28274# Royal Signals and Radar Establishment, Malvern (England).
THE DESIGN AND CONSTRUCTION OF A MODULE TO DEMONSTRATE A METHOD FOR TRANSMISSION OF DATA FROM A MEDICAL IMPLANT
I. Morgan and J. D. Benjamin Aug. 1985 30 p
(AD-A163750; RSRE-MEMO-3872; BR98206; ESA-86-97117)
Avail: Issuing Activity

Methods of powering devices to which only ac contact can be made and receiving data transmitted back from them are described. Such devices include medical implants which communicate with the external environment via ultrasound or rf links. Two breadboard systems were built to demonstrate the techniques. In both the device is powered by picking up an ac input and rectifying it. A signal voltage detected by the device is encoded as a frequency, transmitted and decoded. In one case this is performed on a separate channel from that used to power the device. In the other only one channel is used for both signals, and data is transmitted by modulating the impedance presented by the

device. The resulting modulation of the input signal is picked up by the external circuit and decoded. ESA

N86-28275*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Jan. - Mar. 1986
E. C. Posner, ed. 15 May 1986 222 p
(Contract NAS7-918)
(NASA-CR-177229; JPL-TDA-PR-42-85; NAS 1.26:177229) Avail: NTIS HC A10/MF A01 CSCL 17B

This publication, one of a series formerly titled The Deep Space Network (DSN) Progress Report, documents DSN progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations. In addition, developments in Earth-based radio technology as applied to geodynamics, astrophysics, and the radio search for extraterrestrial intelligence are reported. For individual titles, see N86-28276 through N86-28294.

N86-28276*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOTAL IONOSPHERIC ELECTRON CONTENT CALIBRATION USING SERIES GPS SATELLITE DATA **c46**
G. Lanyi *In its* The Telecommunications and Data Acquisition Report 15 May 1986 12 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 04A

The current status of the Deep Space Network advanced systems research into ionospheric calibration techniques, based on Global Positioning System (GPS) data is described. A GPS-based calibration system is planned to replace the currently used Faraday rotation method by 1989. The SERIES receiver system determines the differential group delay of signals transmitted at two different carrier frequencies. This differential delay includes an ionospheric component and a GPS transmitter offset. The transmitter offsets are different for each GPS satellite. Tests were conducted to assess the effect of the offsets on the ionospheric calibration accuracy. From the obtained data, the total electron content and GPS transmitter offsets are calculated by a least squares estimation method employing a local model of total ionospheric electron content. The end product is an estimation of the total ionospheric content for an arbitrary line-of-sight direction. For the presented polynomial fitting technique, the systematic error due to mismodeling is estimated to be approximately 6 x 10 to the 16th power el/sq m, while the formal error is approximately 2 x 10 to the 16th power el/sq m. The final goal is an error of 3 x 10 to the 16th power el/sq m (approximately 0.7 ns at 2.3 GHz). Author

N86-28277*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETS AS BACKGROUND NOISE SOURCES IN FREE SPACE OPTICAL COMMUNICATIONS
J. Katz *In its* The Telecommunications and Data Acquisition Report 15 May 1986 12 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

Background noise generated by planets is the dominant noise source in most deep space direct detection optical communications systems. Earlier approximate analyses of this problem are based on simplified blackbody calculations and can yield results that may be inaccurate by up to an order of magnitude. Various other factors that need to be taken into consideration, such as the phase angle and the actual spectral dependence of the planet albedo, in order to obtain a more accurate estimate of the noise magnitude are examined. Author

N86-28278*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SIMPLE METHOD FOR DESIGNING OR ANALYZING AN OPTICAL COMMUNICATION LINK
J. R. Lesh, W. K. Marshall, and J. Katz *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

A simple method is described for determining the performance of a free space optical communication link. The method can be used either in the system design (synthesis) mode or in the performance evaluation (analysis) mode. Although restricted to photo counting based detection of pulse position modulated signals, the method is still sufficiently general to accommodate space-based, as well as ground-based, reception. Author

N86-28279*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAXIMUM LIKELIHOOD ESTIMATION OF SIGNAL-TO-NOISE RATIO AND COMBINER WEIGHT
S. Kalson and S. J. Dolinar *In its* The Telecommunications and Data Acquisition Report 15 May 1986 10 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

An algorithm for estimating signal to noise ratio and combiner weight parameters for a discrete time series is presented. The algorithm is based upon the joint maximum likelihood estimate of the signal and noise power. The discrete-time series are the sufficient statistics obtained after matched filtering of a biphase modulated signal in additive white Gaussian noise, before maximum likelihood decoding is performed. Author

N86-28280*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A VLSI PIPELINE DESIGN OF A FAST PRIME FACTOR DFT ON A FINITE FIELD
T. K. Truong, I. S. Hsu, H. M. Shao, I. S. Reed (University of Southern California, Los Angeles), and H. C. Shyu *In its* The Telecommunications and Data Acquisition Report 15 May 1986 11 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

A conventional prime factor discrete Fourier transform (DFT) algorithm is used to realize a discrete Fourier-like transform on the finite field, GF(q sub n). A pipeline structure is used to implement this prime factor DFT over GF(q sub n). This algorithm is developed to compute cyclic convolutions of complex numbers and to decode Reed-Solomon codes. Such a pipeline fast prime factor DFT algorithm over GF(q sub n) is regular, simple, expandable, and naturally suitable for VLSI implementation. An example illustrating the pipeline aspect of a 30-point transform over GF(q sub n) is presented. Author

N86-28281*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FAST FREQUENCY ACQUISITION VIA ADAPTIVE LEAST SQUARES ALGORITHM
R. Kumar *In its* The Telecommunications and Data Acquisition Report 15 May 1986 9 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

A new least squares algorithm is proposed and investigated for fast frequency and phase acquisition of sinusoids in the presence of noise. This algorithm is a special case of more general, adaptive parameter-estimation techniques. The advantages of the algorithms are their conceptual simplicity, flexibility and applicability to general situations. For example, the frequency to be acquired can be time varying, and the noise can be nonGaussian, nonstationary and colored. As the proposed algorithm can be made recursive in the number of observations, it is not necessary to have a priori knowledge of the received signal-to-noise ratio or to specify the measurement time. This would be required for batch processing techniques, such as the fast Fourier transform (FFT). The proposed algorithm improves the frequency estimate on a recursive basis as more and more observations are obtained. When the algorithm is applied in real time, it has the extra advantage that the observations need not be stored. The algorithm also yields a real time confidence measure as to the accuracy of the estimator. Author

N86-28282*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SYSTOLIC ARCHITECTURE FOR THE CORRELATION AND ACCUMULATION OF DIGITAL SEQUENCES **c33**
L. J. Deutsch and C. R. Lahmeyer *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09C

A fully systolic architecture for the implementation of digital sequence correlator/accumulators is described. These devices consist of a two-dimensional array of processing elements that are conceived for efficient fabrication in Very Large Scale Integrated (VLSI) circuits. A custom VLSI chip that was implemented using these concepts is described. The chip, which contains a four-lag three-level sequence correlator and four bits of accumulation with overflow detection, was designed using the Integrated UNIX-Based Computer Aided Design (CAD) System. Applications of such devices include the synchronization of coded telemetry data, alignment of both real time and non-real time Very Large Baseline Interferometry (VLBI) signals, and the implementation of digital filters and processes of many types. Author

N86-28283*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI OBSERVATIONS OF 416 EXTRAGALACTIC RADIO SOURCES **c93**
D. D. Morabito, A. E. Niell, R. A. Preston, R. P. Linfield, A. E. Wehrle, and J. Faulkner *In its* The Telecommunications and Data Acquisition Report 15 May 1986 16 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 03B

The Deep Space Network is establishing a high-accuracy Very Long Base Interferometry (VLBI) celestial reference frame. Presented are the VLBI results of observations of 416 radio sources with declination north of -45 degrees which were conducted at frequencies of 2.3 GHz and 8.4 GHz. At 2.3 GHz 323 of 391 radio sources observed were detected with a fringe spacing of 3 milliarcsec and a detection limit of approximately 0.1 Jy. At 8.4 GHz, 278 of 416 radio sources were detected with a fringe spacing of 1 milliarcsec and a detection limit of approximately 0.1 Jy. This survey was conducted primarily to determine the strength of compact components at 8.4 GHz for radio sources previously detected with VLBI at 2.3 GHz. Compact extragalactic radio sources with strong correlated flux densities at both frequencies are used to form a high-accuracy reference frame. Author

N86-28284*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PARKES-CDSCC TELEMETRY ARRAY: EQUIPMENT DESIGN **c17**
D. W. Brown, H. W. Cooper, J. W. Armstrong, and S. S. Kent *In its* The Telecommunications and Data Acquisition Report 15 May 1986 26 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09F

A unique combination of Deep Space Network (DSN) and non-DSN facilities in Australia provided enhanced data return from the Voyager spacecraft as it encountered the planet Uranus. Many of the key elements are duplicated from Voyager's encounters with Jupiter and Saturn. Some are unique extensions of that technology. Author

N86-28285*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSA'S SUBCARRIER DEMODULATION LOSSES
M. Simon and A. Mileant *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

The degradation in bit error rate performance due to imperfect subcarrier tracking by the Demodulation Synchronization Assembly (DSA) is investigated. Results apply to any type of digital loop and received signal dynamics. A type four loop causes the least amount of loss, because it tracks phase jerk with zero steady-state error. However, when frequency rate and frequency acceleration are as large as in the extended Magellan mission, it will be necessary to decrease the loop update time in order to minimize the losses. Author

N86-28286*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SNR ESTIMATION FOR THE BASEBAND ASSEMBLY
M. K. Simon and A. Mileant *In its* The Telecommunications and Data Acquisition Report 15 May 1986 9 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

The expected value and the variance of the Baseband Assembly symbol signal-to-noise ratio (SNR) estimation algorithm are derived. The SNR algorithm treated here is designated as the Split Symbol Moments Estimator (SSME). It consists of averaging the first two moments of the integrated half symbols. The SSME is a biased, consistent estimator. The SNR degradation factor due to the jitter in the subcarrier demodulation and symbol synchronization loops is taken into account. Curves of the expected value of the SNR estimator versus the actual SNR are presented. Author

N86-28287*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE NEW 34-METER ANTENNA
M. F. Pompa *In its* The Telecommunications and Data Acquisition Report 15 May 1986 12 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

The new 34-m high efficiency Azimuth - Elevation antenna configuration, including its features, dynamic characteristics and performance at 8.4-GHz frequencies is described. The current-technology features of this antenna produce a highly reliable configuration by incorporation of a main wheel and track azimuth support, central pintle pivot bearing, close tolerance surface panels and all-welded construction. Also described are basic drive controls that, as slaved to three automatic microprocessors, provide accurate and safe control of the antenna's steering tasks. At this time antenna installations are completed at Goldstone and Canberra and have operationally supported the Voyager - Uranus encounter. A third installation is being constructed currently in Madrid and is scheduled for completion in late 1986. Author

N86-28288*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK TRACKING SYSTEM, MARK 4-A, 1986 **c17**
J. A. Wackley *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09D

The Deep Space Network (DSN) Tracking System provides highly precise measurements of spacecraft Doppler and range. It was recently extensively modified as part of the Mark 4-A implementation. The DSN Tracking System as currently implemented, its performance in support of Voyager 2, and plans for new implementation are described. Author

N86-28289*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MARK 4A DSN RECEIVER-EXCITER AND TRANSMITTER SUBSYSTEMS
M. R. Wick *In its* The Telecommunications and Data Acquisition Report 15 May 1986 10 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 17B

The present configuration of the Mark 4A DSN Receiver-Exciter and Transmitter Subsystems is described. Functional requirements and key characteristics are given to show the differences in the capabilities required by the Networks Consolidation task for combined High Earth Orbiter and Deep Space Network tracking support. Author

N86-28290*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HVAC MODIFICATIONS AND COMPUTERIZED ENERGY ANALYSIS FOR THE OPERATIONS SUPPORT BUILDING AT THE MARS DEEP SPACE STATION AT GOLDSTONE c31
A. Halperin and P. Stelzmuller *In its* The Telecommunications and Data Acquisition Report 15 May 1986 12 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 13B

The key heating, ventilation, and air-conditioning (HVAC) modifications implemented at the Mars Deep Space Station's Operation Support Building at Jet Propulsion Laboratories (JPL) in order to reduce energy consumption and decrease operating costs are described. An energy analysis comparison between the computer simulated model for the building and the actual meter data was presented. The measurement performance data showed that the cumulative energy savings was about 21% for the period 1979 to 1981. The deviation from simulated data to measurement performance data was only about 3%. Author

N86-28291*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REVERSE OSMOSIS WATER PURIFICATION SYSTEM c54
H. G. Ahlstrom, P. S. Hames, and F. J. Menninger *In its* The Telecommunications and Data Acquisition Report 15 May 1986 10 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 06K

A reverse osmosis water purification system, which uses a programmable controller (PC) as the control system, was designed and built to maintain the cleanliness and level of water for various systems of a 64-m antenna. The installation operates with other equipment of the antenna at the Goldstone Deep Space Communication Complex. The reverse osmosis system was designed to be fully automatic; with the PC, many complex sequential and timed logic networks were easily implemented and are modified. The PC monitors water levels, pressures, flows, control panel requests, and set points on analog meters; with this information various processes are initiated, monitored, modified, halted, or eliminated as required by the equipment being supplied pure water. Author

N86-28292*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE VENUS BALLOON PROJECT c91
C. T. Stelzried, R. A. Preston, C. E. Hildebrand, J. H. Wilcher, and J. Ellis *In its* The Telecommunications and Data Acquisition Report 15 May 1986 8 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 03B

On June 11 and 15, 1985, two instrumental balloons were released from the Soviet VEGA 1 and VEGA 2 spacecraft and deployed in the atmosphere of Venus. The VEGA probes flew by the planet on their way to a rendezvous with comet Halley in March 1986. Drifting with the wind at altitudes of 54 km, the balloons traveled one-third of the way around the planet during their 46-hour lifetimes. Sensors on-board the gondolas made periodic measurements of pressure, temperature, vertical wind velocity, cloud particle density, ambient light level, and frequency of lightning. The data were transmitted to Earth and received at the Deep Space Network (DSN) 64-m stations and at several large antennas in the USSR. Approximately 95 percent of the telemetry data were successfully decoded at the DSN complexes and in the Soviet Union, and were provided to the international science team for analysis. Very Long Baseline Interferometry (VLBI) data were acquired by 20 radio observatories around the world for the purpose of monitoring the Venus winds. The DSN 64-m subnet was part of a 15-station VLBI network organized by the Centre National d'Etudes Spatiales (CNES) of France. In addition, five antennas of the Soviet network participated. VLBI data from the CNES network are currently being processed at the Jet Propulsion Laboratory. Author

N86-28293*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE VENUS BALLOON PROJECT TELEMETRY PROCESSING c17
J. M. Urech, A. Chamarro, J. L. Morales, and M. A. Urech *In its* The Telecommunications and Data Acquisition Report 15 May 1986 13 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09D

The peculiarities of the Venus Balloon telemetry system required the development of a new methodology for the telemetry processing, since the capabilities of the Deep Space Network (DSN) telemetry system do not include burst processing of short frames with two different bit rates and first bit acquisition. A software package was produced for the non-real time detection, demodulation, and decoding of the telemetry streams obtained from an open loop recording utilizing the DSN spectrum processing subsystem-radio science (DSP-RS). A general description of the resulting software package (DMO-5539-SP) and its adaptability to the real mission's variations is contained. Author

N86-28294*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MARCH 1985 DEMONSTRATION OF THE FIDUCIAL NETWORK CONCEPT FOR GPS GEODESY: A PRELIMINARY REPORT c43
J. M. Davidson, C. L. Thornton, T. H. Dixon, C. J. Vegos, L. E. Young, and T. P. Yunck *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 08E

The first field tests in preparation for the NASA Global Positioning System (GPS) Caribbean Initiative were conducted in late March and Early April of 1985. The GPS receivers were located at the POLARIS Very Long Base Interferometry (VLBI) stations at Westford, Massachusetts; Richmond, Florida; and Ft. Davis, Texas; and at the Mojave, Owens Valley, and Hat Creek VLBI stations in California. Other mobile receivers were placed near Mammoth Lakes, California; Pt. Mugu, California; Austin, Texas; and Dahlgren, Virginia. These sites were equipped with a combination of GPS receiver types, including SERIES-X, TI-4100 and AFGL dual frequency receivers. The principal objectives of these tests were the demonstration of the fiducial network concept for precise GPS geodesy, the performance assessment of the participating GPS receiver types, and to conduct the first in a series of experiments to monitor ground deformation in the Mammoth Lakes-Long Valley caldera region in California. Other objectives included the testing of the water vapor radiometers for the calibration of GPS data, the development of efficient procedures for planning and coordinating GPS field exercise, the establishment of institutional interfaces for future cooperating ventures, the testing of the GPS Data Analysis Software (GIPSY, for GPS Inferred Positioning SYstem), and the establishment of a set of calibration baselines in California. Preliminary reports of the success of the field tests, including receiver performance and data quality, and on the status of the data analysis software are given. Author

N86-28295*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TRELLIS CODED MODULATION FOR 4800-9600 BPS TRANSMISSION OVER A FADING MOBILE SATELLITE CHANNEL
Dariush Divsalar and M. K. Simon 1 Jan. 1986 46 p
(Contract NAS7-918)
(NASA-CR-177159; JPL-PUB-86-8; NAS 1.26:177159) Avail: NTIS HC A03/MF A01 CSCL 17B

The combination of trellis coding and multiple phase-shift-keyed (MPSK) signalling with the addition of asymmetry to the signal set is discussed with regard to its suitability as a modulation/coding scheme for the fading mobile satellite channel. For MPSK, introducing nonuniformity (asymmetry) into the spacing between signal points in the constellation buys a further improvement in performance over that achievable with trellis coded symmetric MPSK, all this without increasing average or peak power, or changing the bandwidth constraints imposed on the system. Whereas previous contributions have considered the performance of trellis coded modulation transmitted over an additive white

Gaussian noise (AWGN) channel, the emphasis in the paper is on the performance of trellis coded MPSK in the fading environment. The results will be obtained by using a combination of analysis and simulation. It will be assumed that the effect of the fading on the phase of the received signal is fully compensated for either by tracking it with some form of phase-locked loop or with pilot tone calibration techniques. Thus, results will reflect only the degradation due to the effect of the fading on the amplitude of the received signal. Also, we shall consider only the case where interleaving/deinterleaving is employed to further combat the fading. This allows for considerable simplification of the analysis and is of great practical interest. Finally, the impact of the availability of channel state information on average bit error probability performance is assessed. Author

N86-28296*# Texas A&M Univ., College Station. Dept. of Electrical Engineering.
TWO HYBRID ARQ ERROR CONTROL SCHEMES FOR NEAR EARTH SATELLITE COMMUNICATIONS
Shu Lin 4 Aug. 1986 16 p
(Grant NAG5-778)
(NASA-CR-177179; NAS 1.26:177179; TR-1) Avail: NTIS HC A02/MF A01 CSCL 17B

Two hybrid Automatic Repeat Request (ARQ) error control schemes are proposed for NASA near Earth satellite communications. Both schemes are adaptive in nature, and employ cascaded codes to achieve both high reliability and throughput efficiency for high data rate file transfer. Author

N86-28297# Defense Communications Engineering Center, Reston, Va.
PERFORMANCE ANALYSIS OF DIGITAL LOS LINK MORMOND HILL-LATHERON, UK (M0672)
Nicholas J. Sorovacu Sep. 1985 24 p
(AD-A165635; DCEC-TR-7-83) Avail: NTIS HC A02/MF A01 CSCL 17/2

The U.S. Navy has been tasked to upgrade link M0672, Mormond Hill-Latheron, UK for digital operations. Technical guidance was requested from the Defense Communications Engineering Center (DCEC) to analyze link performance expected of the digital configuration and to assess the potential of using DIDICOM units in conjunction with quad diversity. GRA

N86-28298# Mitre Corp., Bedford, Mass.
EXPERT SYSTEMS FOR C3I. VOLUME 1. A USER'S INTRODUCTION Final Report
J. A. Clapp, S. M. Hockett, M. J. Prelle, A. M. Tallant, and D. D. Triant Oct. 1985 60 p
(Contract F19628-84-C-0001)
(AD-A165693; ESD-TR-85-125) Avail: NTIS HC A04/MF A01 CSCL 17/2

There has been a tremendous burgeoning of interest in artificial intelligence (AI) over the last few years. Investments of commercial and government sponsors reflect a widespread belief that AI is now ready for practical applications. The area of AI currently receiving the greatest attention and investment is expert system technology. Most major high tech corporations have begun to develop expert systems, and many software houses specializing in expert system tools and applications have recently appeared. The defense community is one of the heaviest investors in expert system technology, and within this community one of the application areas receiving greatest attention is C3I. Many ESD programs are now beginning to ask whether expert system applications for C3I are ready for incorporation into ESD-developed systems, and, if so, what are the potential benefits and risks of doing so. This report was prepared to help ESD and MITRE personnel working on acquisition programs to address these issues and to gain a better understanding of what expert systems are all about. The primary intention of this report is to investigate what expert systems are and the advances that are being made in expert system technology for C3I applications. The report begins with a brief tutorial on expert systems, emphasizing how they differ from conventional software systems and what they are best at doing. GRA

N86-28299# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
BEST APPROXIMATION OF SIGNAL AMPLITUDE AND DELAY IN A NARROWBAND RADAR
Richard C. Raup 22 Jan. 1986 48 p
(Contract F19628-85-C-0002)
(AD-A165700; TR-723; ESD-TR-85-311) Avail: NTIS HC A03/MF A01 CSCL 17/9

The range estimation problem is generally solved by assuming a low order target mass center motion description (such as constant velocity or constant acceleration) or by postulating a well defined manuever. Assumptions are often made that require the receiver signal associated with a well tracked target to have a narrow bandwidth. These assumptions are unreasonable for certain range estimation problems. An approach general enough for use with virtually any pulsed narrowband transmitter waveform and a variety of finite parameter descriptions of time varying target range and cross section is developed. The associated best approximation problem is nonlinear but has a special structure which permits a computable solution in applications of interest involving thousands of unknowns. An Appendix provides an example of estimating a polynomial propagation delay from observations of the radar receiver signal. GRA

N86-28300# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
RESTRUCTURABLE VLSI PROGRAM Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1985
Gerald C. OLeary 30 Sep. 1985 22 p
(Contracts F19628-85-C-0002; ARPA Order 3797; DA Proj. 3D3-0)
(AD-A165718; ESD-TR-85-293) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes work performed on the Restructurable VLSI Program sponsored by the Information Processing Techniques Office of the Defense Advanced Research Projects Agency during the period 1 April through 30 September 1985. GRA

N86-28301# Naval Research Lab., Washington, D. C.
ESTIMATING THE SCATTERING COEFFICIENT OF THE OCEAN SURFACE FOR HIGH-FREQUENCY OVER-THE-HORIZON RADAR
R. O. Pilon and J. M. Headrick 28 Mar. 1986 23 p
(AD-A165722; NRL-MR-5741) Avail: NTIS HC A02/MF A01 CSCL 17/9

Several methods for determining the radar scattering coefficient of the ocean surface, sigma (o), all based on the technique developed by Trizna, have been applied to two sets of High-Frequency Over-the-Horizon (HF OTH) data. One specific method is found to yield the best results. A method of operation of an HF OTH system to allow the estimation of sigma (o) is recommended. GRA

N86-28302# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Inst. Group.
COHERENT c-BAND TRANSPONDER STANDARDS
Feb. 1986 27 p
(AD-A165811; IRIG-STANDARD-257-86) Avail: NTIS HC A03/MF A01 CSCL 17/7

The objective of this document is to define minimum transponder parameters in such a manner that any C-band instrumentation radar on any test range may use the transponder. It is not the goal of these standards to require all transponders to use the same pulse code spacing or the same spot frequencies. Rather, it is to establish an envelope of frequencies and codes within which all test ranges may operate. In this way, the goals can be met and yet the interference-free traffic capacity will be larger than if only one system of codes and spot frequencies was used. Many of the parameters can and will undoubtedly be improved. There are three basic designs of a coherent pulse radar transponder; however, only two are in use for trajectory measurement

application. Both employ superheterodyne receivers, delay at the intermediate frequency, and heterodyne the signal back to the carrier frequency through the use of a common local oscillator. If the transponder has good stability, the phase of the reply will bear a fixed relationship to the interrogation signal. The difference between the two transponder types occur in the transmitter section. One design achieves power gain by cascading injection locked oscillators. GRA

N86-28303# Westinghouse Electric Corp., Pittsburgh, Pa. Power System Engineering Dept.
ELECTROMAGNETIC TRANSIENTS PROGRAM (EMTP) PRIMER Final Report
S. F. Mauser and T. E. McDermott Sep. 1985 265 p Sponsored by EPRI
(EPRI Proj. 2149-1)
(DE86-000060; EPRI-EL-4202) Avail: NTIS HC A12/MF A01

This document is an outgrowth of a survey and analysis of Electromagnetic Transients Program (EMTP) user needs, in which improved user's documentation was determined to be the single most important enhancement to the EMTP. The Primer is an EMTP training manual for new users. It includes introductory material and eleven sample studies so that the reader can learn by the case study method. The Primer is part of a series of new EMTP user manuals which covers program operation, theory, and application guide lines. DOE

N86-28304# Centre National d'Etudes Spatiales, Toulouse (France). Div. Trans., Instr. et Traitement de Bord.
STAR HIGH BIT RATE LINK MODEL: THE CARRIER REGENERATION [MAQUETTE DE LIAISON HAUTE CADENCE STAR: LA REGENERATION DE PORTEUSE]
M. Grondin 29 Oct. 1984 50 p In FRENCH; ENGLISH summary
(CNES-84/331-T-CT/DRT/TIT/TR; ESA-86-97181) Avail: NTIS HC A03/MF A01

A simulation breadboard Star model was designed and implemented to work at up to 200 Mbps through a data relay satellite. The carrier regenerator module design and performance are discussed. The 46 Hz receiver, treating 4 phase shift keyed signals, is based on a remodulation-demodulation concept, which has the advantage of giving demodulated signals in phase and quadrature. The choice of a voltage controlled oscillator with better thermal stability; the problems caused by poor knowledge of circuit delays and transit times; and the unavoidable Doppler effect are discussed. The utilization of dedicated integrated circuits would improve the overall performance. ESA

N86-28305# Centre National d'Etudes Spatiales, Toulouse (France).
STAR HIGH RATE LINK MODEL: CLOCK REGENERATION [MAQUETTE DE LIAISON HAUTE CADENCE STAR: LA REGENERATION D'HORLOGE]
J. P. Soldermann and M. Grondin 29 Nov. 1984 30 p In FRENCH; ENGLISH summary
(CNES-CT/DRT/TIT/TR-84/349-T; ESA-86-97184) Avail: NTIS HC A03/MF A01

The receiving part of this module, used in spacecraft transmission through a relay satellite, requires a very accurate clock reference in the extraction of data from a QPSK modulated signal at a bit rate of 100 MHz. The results achieved to improve this accuracy working on the nonlinear treatment and the narrow band filtering are described. The chosen clock detector is based on a delay line and a multiplier. The multiplication is assured in ECL logic by an exclusive or. The filter is based on a narrow band phase loop. It is shown that the performance degradation introduced by the clock regenerator is 0.2 dB if the static phase error is kept within 5 deg. ESA

N86-28306# Ekonomisk Foretagsledning, Stockholm (Sweden).
THE BENEFITS OF MOBILE COMMUNICATIONS
Paris ESA Apr. 1985 40 p
(Contract ESA-5982/84-F-RD(SC))
(ESA-CR(P)-2160; ESA-86-96862) Avail: NTIS HC A03/MF A01

The benefits offered by mobile communications facilities are compared to conventionally priced networks. Sweden, the UK and Eire were taken as examples of markets that are respectively leading, growing and restrictive. The three major benefits identified are higher profits for commercial organizations from cost savings and improved productivity, the prevention and minimization of damage to life and property, and better social contacts for people isolated from communities. Case studies provide examples of the benefits different occupational and social groups acquire from mobile communications in each country. The studies were also used to project future growth in the uptake and range of mobile communications facilities offered in each country. ESA

N86-28307# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung HF-Systeme.
DEVELOPMENT OF A LINEAR BACKFIRE ANTENNA FOR AN AIRBORNE L-BAND SCATTEROMETER
Helmut Haerter and Bernd Mayr Oct. 1985 20 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-85-15; ISSN-0176-7739; ESA-86-96884) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 9.50

A short backfire antenna with four feeding elements was developed for airborne applications. The specifications and the design of the antenna are presented. The technical performance and the sizing of the antenna are described. ESA

N86-28308# Bundesministerium fuer Wissenschaft und Forschung, Vienna (Austria).
SATELLITE COMMUNICATION TECHNIQUES. FUNDAMENTALS, SYSTEMS, AND PROJECTS [SATELLITENNACHRICHTENTECHNIK GRUNDLAGEN, SYSTEME UND PROJEKTE]
W. Lothaller May 1985 285 p In GERMAN Sponsored by Bundesministerium fuer Wissenschaft und Forschung, Austrian Post- und Telegraphenverwaltung, Bundeskammer der gewerblichen Wirtschaft, Vereinigung Oesterreichischer Industrieller, Austria Metall AG, Elin Union AG, Oesterreichische Raumfa
(ESA-86-96937) Avail: NTIS HC A13/MF A01

Worldwide projects involving communication satellites are reviewed, emphasizing technical aspects, tasks, and realization. Satellite communication fundamentals, and boundary conditions in space and their consequences for systems design and satellite construction are explained. European projects and international systems of interest to Austria are presented. The historical development of European communication satellites is depicted. ESA

N86-28309# Rijksluchtvaartdienst, The Hague (Netherlands).
FUTURE AERONAUTICAL COMMUNICATION SYSTEM (FACS): REPORT
H. J. Hof Jun. 1985 102 p In DUTCH
(ESA-86-96959) Avail: NTIS HC A06/MF A01

The feasibility of a FACS design, particularly with regard to application possibilities of satellites, was investigated. It was assumed that communication between airborne stations and air traffic control centers is exclusively possible via satellites using mainly voice communication (possibly completed by data communication). It is concluded that integration possibilities of satellites are mainly limited by the airborne antenna chosen. As a solution, phase steered microstrip antenna arrays are presented. However, the use of these antennas is limited to large (long-distance) aircraft. For operational feasibility, it is concluded that communication should take place in the high frequency band. ESA

N86-28310# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
ELECTROMAGNETIC COMPATIBILITY ON PRINTED CIRCUIT BOARDS
L. J. M. Joosten 6 Sep. 1984 19 p In DUTCH; ENGLISH summary Presented at PATO Course on Electromagnetic Compatibility, 14-23 Nov. 1984

(NLR-MP-84087-U; B8578428; ESA-86-96972) Avail: NTIS HC A02/MF A01

Guidelines concerning the design and layout of the wiring on a printed circuit board are outlined. Applications in the digital and analog field for frequencies up to the microwave band are shown. ESA

N86-28311# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

METHODS FOR THE GENERATION OF SIGNALS FOR SUSCEPTIBILITY MEASUREMENTS

O. B. M. Pietersen 4 Sep. 1984 25 p In DUTCH; ENGLISH summary Presented at PATO Course on Electromagnetic Compatibility, 14-23 Nov. 1984

(NLR-MP-84088-U; B8578429; ESA-86-96973) Avail: NTIS HC A02/MF A01

Means to generate interference fields, currents, and tensions in electronic apparatus for the quantitative determination of their susceptibility are presented. Transducers such as magnetic loop antennas, coaxial and microstrip structures to generate high field strength, and specialized electromagnetic interference antennas are discussed. ESA

N86-28312# Uppsala Ionospheric Observatory (Sweden).

STANDING WAVE PATTERN OF HF RADIO WAVES IN THE IONOSPHERIC REFLECTION REGION. PART 2: APPLICATIONS

Bengt Lundborg and Bo Thide 29 Oct. 1985 47 p Sponsored by Swedish Natural Science Research Council

(UIO-SR-85-05-Pt-2; ISSN-0349-2699; ESA-86-97029) Avail: NTIS HC A03/MF A01

General analytical formulas derived within a uniform approximation are utilized for determining the wave pattern of a vertically propagating HF wave totally or partially reflected from the ionosphere. The full three-dimensional wave is calculated accurately, also at the reflection point. Parameter values are typical of ionospheric modification experiments as two sites are chosen. The influence of the geomagnetic field and collisions are properly taken into account but nonlinear and coupling effects are excluded. It is shown that the geomagnetic field affects the wave pattern strongly and leads to a very high swelling in the first wave maximum below the reflection point. ESA

N86-28313# Uppsala Ionospheric Observatory (Sweden).

STRUCTURE OF HF PUMP IN IONOSPHERIC MODIFICATION EXPERIMENTS. LINEAR TREATMENT

Bo Thide and Bengt Lundborg 21 Nov. 1985 21 p Submitted for publication Sponsored by Swedish Natural Science Research Council

(UIO-SR-86-06; ISSN-0349-2699; ESA-86-97030) Avail: NTIS HC A02/MF A01

In order to demonstrate the versatility and flexibility of the uniform approximation technique for solving the problem of propagation of radio waves in an inhomogeneous, collisional, and magnetized plasma, the standing wave pattern of an O-mode radio wave reflected from an ionospheric Chapman layer is calculated. Comparisons with results obtained from standard formulas show the superiority of the uniform approximation method. The derivation of the accurate analytic uniform approximation formulas is motivated by the need for a detailed analysis of nonlinear wave phenomena induced by the electromagnetic pump in ionospheric modification experiments. ESA

N86-28314# Research Inst. of National Defence, Linkoeping (Sweden).

ADAPTIVE ANTENNAS: MEASUREMENTS ON A TWO-ELEMENT FIX-FREQUENCY SYSTEM IN REAL TERRAIN

Boerje Asp Dec. 1985 49 p Sponsored by Swedish Material Administration of Armed Forces Air Material Department

(FOA-C-30404-E2; ISSN-0347-3708; ESA-86-97037) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

Field measurements on a two-element fix-frequency adaptive system, PV2413A, for 30 to 88 MHz are described. In open fields the system acts very well. In woodland there are cases with impaired cancellation as a result of the multipath environment, but the PV2413A sometimes works better in woodland relative to the open field case. Cancellation depths of 30 to 60 dB are obtained. The measurements were made with a two-element system on a vehicle with three antenna elements. Comparing results from the various combinations shows that an adaptive system with three antenna elements is better suited to manage heavy multipath fading. ESA

N86-28315# Research Inst. of National Defence, Linkoeping (Sweden).

AN INVERSE METHOD FOR THE PROCESSING OF SYNTHETIC APERTURE RADAR DATA

Hans Hellsten and Lars Erik Andersson Jan. 1986 22 p

(FOA-C-30413-E1; ISSN-0347-3708; ESA-86-97040) Avail: NTIS HC A02/MF A01; Research Institute for National Defence, Stockholm, Sweden KR 50

An inverse method for SAR signal processing which is independent of the relative bandwidth of the radar signal is presented. It works when the frequency of the emitted radiation is of the same order as the bandwidth, i.e., in low frequency, high resolution applications. It is shown that the obtained relations reduce to the correlation integrals of conventional SAR image processing in the case that the relative bandwidth of the signal is small. Range attenuation and antenna illumination effects may be fully compensated for. ESA

N86-28316# Fondazione Ugo Bordoni, Rome (Italy).

PERFORMANCE ANALYSIS OF THE FRAME STRUCTURE PROPOSED FOR THE HYBRID DIGITAL HIERARCHY

Odoardo Brugia, Emilio Montolivo, and William Wolfowicz Feb. 1985 12 p

(FUB-2-1985; ESA-86-97081) Avail: NTIS HC A02/MF A01

Frame structures and frame alignment criteria proposed for a mixed digital hierarchy employed for international interworking between networks using different multiplexing standards are analyzed. The average alignment holding time (i.e., the average time interval between of frame alignment for a transmission error ratio) the false alignment probability (i.e., the probability of alignment simulation) and the maximum realignment time with 99.7% probability of its not being exceeded are given. ESA

N86-28317# Fondazione Ugo Bordoni, Rome (Italy).

A PUBLIC-KEY CRYPTOSYSTEM BASED ON A GENERALIZATION OF THE KNAPSACK PROBLEM

Adina DiPorto Apr. 1985 9 p Presented at Eurocrypt, Linz, Austria 9-11 Apr. 1985

(FUB-18-1985; ESA-86-97085) Avail: NTIS HC A02/MF A01

A cryptographic algorithm, based on a generalization of the knapsack problem, which allows encryption of multilevel digit sequences and provides attractive performances from the point of view of secrecy is proposed. A modified algorithm which is much harder to break is presented. The modified algorithm increases security owing to the necessity of factoring large numbers. Both algorithms require generation of large numbers to get a good level of security. ESA

N86-28318# European Space Agency, Paris (France).

INVESTIGATION OF SIGNAL DEGRADATION BY SCATTERING AND ITS SUPPRESSION IN NEAR-GROUND RADAR CROSS SECTION MEASUREMENTS

Karl-Heinz Bethke Jan. 1986 76 p Transl. into ENGLISH from "Untersuchungen zur Stoerstreuung und Methoden zu deren Unterdrueckung bei Bodennahen Radarrueckstrahlmessungen" Oberfaffenhofen, West Germany Original report in GERMAN previously announced as N86-15539

(ESA-TT-967; DFVLR-FB-85-42; ESA-86-96855) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne DM 22

Radar scattering on level ground and edge diffraction in near-ground measurements are discussed. The suppression of

ground reflections by screening fences is considerably improved by mounting additional diffracting metal strips parallel to the top of the fences. Starting with the Fresnel diffraction, a dimensioning procedure for an optimum design for these strip grids with respect to the required homogeneity of the field at the location of the object to be measured is developed. The practical improvement obtained by using strip grids is demonstrated by taking radar cross section measurements on a metal target with pronounced anisotropic backscatter characteristics. ESA

N86-28319# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
OPTIMIZED TE01-TO-TM11 MODE CONVERSION IN HIGHLY OVERMODED CIRCULAR WAVEGUIDE AT 70 AND 140 GHz
H. Sturm Jun. 1985 66 p In GERMAN; ENGLISH summary (IPF-85-5; ESA-86-96923) Avail: NTIS HC A04/MF A01

Mode coupling in bent, oversized, smoothly walled circular waveguides was studied by numerical integration of coupled-mode equations, to optimize high power TE01-to-TM11 mode transducers at 70 and 140 GHZ. Such transducers are used in the mode conversion sequence TE on to TE01 to TM11 to HE11 to generate the linearly polarized HE11 (Gaussianlike) mode from the circular electric TE on gyrotron mode. The balanced HE11 hydrid mode is ideal for electron cyclotron plasma heating in thermonuclear fusion research and for other technical applications. The lowest level of unwanted spurious modes is achieved with sinusoidal curvature distribution instead of constant curvature. The calculated efficiencies of 98.0% at 70 GHZ and 95.2% at 140 GHZ (inner diameter 27.79 mm, ohmic attenuation included) are in excellent agreement with the measured values (97.6% and 95%) respectively. ESA

N86-28320# Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany). Fachgebiete: Meteorologie, Ozeanographie, Physik des Erdkoerpers.
RADAR BACKSCATTERING EXPERIMENTS IN A WIND-WAVE TUNNEL ON CLEAN SURFACES ON SURFACES COVERED WITH A SURFACE FILM, IN THE X BAND (9.8 GHz) [RADAR RUECKSTREUEXPERIMENTE AM WIND-WELLEN-KANAL BEI SAUBERER UND FILMBEDECKTER WASSEROBERFLAECHE IM X-BAND (9.8 GHZ)]
Folkart Feindt Hamburg University 1985 238 p In GERMAN (Rept-75; ESA-86-96926) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38

The average radar backscattering cross section for several conditions and the radar signal modulation due to long waves on clean and film-covered water surfaces were measured. The spectral energy of the Bragg waves was calculated from the measured wave spectra. The damping due to three monomolecular surface films with different physical properties was determined. The degree and phase of the wave-radar modulation transfer function were measured for several wind velocities, incidence angles, polarizations, and antenna viewing directions. ESA

N86-28321# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
REPORT FROM THE SYMPOSIA ON ANTENNAS AND PROPAGATION
Stefan Mattsson Dec. 1985 90 p Partly in ENGLISH and SWEDISH Proceedings of ISAP, Kyoto, Japan, 20-22 Aug. 1985 and ISAE, Beijing, China, 26-28 Aug. 1985
(FOA-C-30409-E2; ISSN-0347-3708; ESA-86-97038) Avail: NTIS HC A05/MF A01; Research Institute of National Defence, Stockholm, KR 50

Communications including shortwave; mobile radio; radiolink; satellite networks; and array, microstrip, adaptive, and reflector type antennas; surface and underground antennas; and waves were treated. Rain attenuation was discussed. Multipath propagation on radiolinks, and the interference between terrestrial links and satellite links were considered. ESA

N86-28350# Kaiserslautern Univ. (West Germany). Lehrstuhl fuer Grundlagen der Elektrotechnik.
DIGITAL CORRELATION PROCESSORS FOR SPREAD-SPECTRUM-COMMUNICATION-SYSTEMS
Hans-Joachim Fischer and A. Baier *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 10 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28353# Physics and Electronics Lab. TNO, The Hague (Netherlands).
REAL-TIME DIGITAL MATCHED FILTER FOR RADAR PULSE COMPRESSION
J. Wiltschut and G. A. Breems *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 8 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28355# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
HIGH SPEED DIGITAL IMAGE PROCESSING FUNCTIONS FOR A REALTIME SYNTHETIC APERTURE RADAR PROCESSOR
Roland Schotter and Horst Froelich *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 6 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28356# Standard Telecommunication Labs. Ltd., Harlow (England).
A SYSTOLIC ARRAY FOR HIGH PERFORMANCE ADAPTIVE BEAMFORMING
C. R. Ward and P. J. Hargrave *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 6 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28357# Communications Research Centre, Ottawa (Ontario).
PROCESSING REQUIREMENTS FOR RADAR DIGITAL BEAMFORMING
J. Litva *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 16 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28368# Royal Signals and Radar Establishment, Malvern (England).
ADVANCED SIGNAL PROCESSING TECHNOLOGY FOR FUTURE RADAR SYSTEMS
C. Pell, A. C. Fairhead, and M. B. Thomas *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 15 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28426*# Genoa Univ. (Italy).
NATURAL ELF NOISE EVALUATION FOR TSS EMISSIONS DETECTION ON THE EARTH'S SURFACE. THE ELECTRIC FIELD COMPONENT APPROACH
Giorgio Tacconi *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 421-430 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28427*# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. Fisica Spazio Interplanetario.
SPONTANEOUS RADIATION EMITTED BY MOVING TETHERED SYSTEMS
Marino Dobrowolny *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 431-439 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28429*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PLASMA CONTACTOR PERFORMANCE CHARACTERIZATION
Paul Wilbur *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 483-498 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28496# Technische Univ., Graz (Austria). Inst. for Image Processing and Computer Graphics.
RADARGRAMMETRIC ASPECTS OF SAR DATA EVALUATION
J. Raggam, G. Triebnig, M. F. Buchroithner, G. Domik (Vexcell Corp., Boulder, Colo.), and F. W. Leberl *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 57-64 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

N86-28497# Technische Univ., Graz (Austria). Inst. for Navigation.
SYNTHETIC APERTURE RADAR (SAR) PRODUCT SIMULATION
Ph. Hartl, A. Popella (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany), and A. J. Sieber *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 65-72 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-28322*# Novar Electronics Corp., Barberton, Ohio.
NEAR FIELD TO FAR FIELD TRANSFORMATIONS AND MULTIPLE BEAM FORMING AND STEERING Final Report
19 Nov. 1984 72 p
(Contract NAS9-16985)
(NASA-CR-171935; NAS 1.26:171935) Avail: NTIS HC A04/MF A01 CSCL 09C

The feasibility of acoustic verification of microwave near field to far field transformation algorithms using the Phased Array Sonic Simulation System was studied. Existing electromagnetic near field measurement techniques and transformation algorithms (equations) were investigated. It was analytically determined that acoustic verification is valid. Acoustic simulation of electromagnetic near field to far field transformations is emphasized. The acoustic simulation of electromagnetic near field to far field transformation is verified for the modal expansion method. In the modal expansion method, data from antenna near field measurements are converted to a summation or spectrum of modes corresponding to wave numbers in the measurement coordinate system. Fourier transformation of those measurements preserves the far field information in a spectral form that is then readily extractable. E.R.

N86-28323*# SRI International Corp., Menlo Park, Calif.
THERMIONIC NOISE MEASUREMENTS FOR ON-LINE DISPENSER CATHODE DIAGNOSTICS FOR LINEAR BEAM MICROWAVE TUBES Final Report, Feb. 1984 - Aug. 1985
Christopher Holland and Ivor Brodie Aug. 1985 48 p
(Contract NAS3-23777; SRI Proj-6923)
(NASA-CR-175105; NAS 1.26:175105) Avail: NTIS HC A03/MF A01 CSCL 09C

A test stand has been set up to measure the current fluctuation noise properties of B- and M-type dispenser cathodes in a typical TWT gun structure. Noise techniques were used to determine the work function distribution on the cathode surfaces. Significant differences between the B and M types and significant changes in the work function distribution during activation and life are found. In turn, knowledge of the expected work function can be used to accurately determine the cathode-operating temperatures in a TWT structure. Noise measurements also demonstrate more sensitivity to space charge effects than the Miram method. Full automation of the measurements and computations is now required to speed up data acquisition and reduction. The complete set of equations for the space charge limited diode were programmed so that given four of the five measurable variables (J, J sub O, T, D, and V) the fifth could be computed. Using this program, we estimated that an rms fluctuation in the diode spacing d in the frequency range of 145 Hz about 20 kHz of only about 10 to the -5 power A would account for the observed noise in a space charge limited diode with 1 mm spacing. Author

N86-28324# Boeing Aerospace Co., Seattle, Wash.
HIGH VOLTAGE PULSE TESTING SURVEY Final Report, 1 Oct. 1984 - 31 Jul. 1985
William G. Dunbar Oct. 1985 80 p
(Contract F33615-81-C-2013)
(AD-A165666; AFWAL-TR-85-2079) Avail: NTIS HC A05/MF A01 CSCL 10/2

The purpose of this work was to lay the technical groundwork necessary to establish new guidelines for high voltage pulse testing waveform parameters, test requirements, test procedures and test limits with respect to insulation characteristics in advanced, high power airborne components. This work has been initiated via this survey which reviews government, industrial and technical society literature concerning impulse and/or pulse testing of military, commercial, and experimental equipment. The survey details the test pulse rise time, dwell time, fall time, and peak voltage applied to evaluate the insulation systems typically found in electrical/electronic aerospace components. Based on the survey findings, a complete specification for a suitable pulse testing apparatus to accomplish such tests is provided. GRA

N86-28325# Royal Signals and Radar Establishment, Malvern (England).
FORMAL PROOF OF CORRESPONDENCE BETWEEN THE SPECIFICATION OF A HARDWARE MODULE AND ITS GATE LEVEL IMPLEMENTATION
C. H. Pygott Nov. 1985 68 p
(AD-A165696; RSRE-85012) Avail: NTIS HC A04/MF A01 CSCL 09/5

The growing use of digital circuits in safety critical environments and the cost of correcting mistakes in large scale integrated circuits, both lead to a requirement for a high level of confidence in the correctness of the design of micro-electronic elements. This paper describes a novel application of a general hardware description language that enables the implementation of a synchronous circuit to be checked exhaustively against a high level, implementation independent, specification of its functionality (originally written in a formalism such as first order predicate calculus). The technique avoids the cost, in simulation time, usually associated with exhaustive checking. The method is illustrated by examples written in the design and description language ELLA: no prior knowledge of ELLA is assumed. Included in the annexes to this paper are a library of ELLA functions that provide those facilities required for the validation of circuits, and the translation of specifications written in the first order predicate calculus language LCF-LSM into ELLA. GRA

N86-28326# Naval Ocean Systems Center, San Diego, Calif.
SUGGESTIONS FOR DESIGNERS OF NAVY ELECTRONIC EQUIPMENT. REVISION A. 1985 EDITION
May 1985 158 p
(AD-A165697; NOSC/TD-250-REV-A) Avail: NTIS HC A08/MF A01 CSCL 09/5

The engineer is provided with common sense recommendations which will increase the reliability of a system in military environments and provides suggestions which will make operation

and maintenance of these equipments easier for Navy personnel. GRA

N86-28327# Washington Univ., Seattle. Dept. of Computer Science.
UW/NW (UNIVERSITY OF WASHINGTON/NORTHWEST) VLSI CONSORTIUM Semiannual Technical Report, 1 Oct. 1985 - 17 Mar. 1986
Lawrence Snyder 17 Mar. 1986 43 p
(Contracts MDA903-85-K-0072; ARPA Order 4563)
(AD-A165748; TR-86-23-02; SATR-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

This document reports on the research activities of the UW/NW VLSI Consortium. During this period, the Consortium staff refined a number of the design generators reported on in the last Technical Report. Two substantial design efforts, a 32 bit microprocessor and a digital filter, utilized several of the generators. Ongoing work focuses on development of interfaces to verification tools such as the DRC and switch level simulators, as well as a functional simulator currently under development. Such interfaces allow the verification tools to make use of the correctness of instances created by generators. A preliminary model for generator construction has been proposed. The intent of the model is to provide a concise specification of the circuit from which a number of output descriptions such as the layout, schematic and transistor netlist may be derived. The model has been applied to both a decoder and a multiplier generator. Work is progressing on a simulation system intended to provide a broad range of capability - from high level behavioral modeling to low level transistor modeling. The system is intended to be used to simulate assemblies of circuits produced by the design generators as well as hand crafted circuits. GRA

N86-28328# New Mexico Univ., Albuquerque.
PREPROCESSING TECHNIQUES FOR THE ESTIMATION OF PARAMETERS FROM NOISY TRANSIENT DATA Final Report, Jul. 1984 - Jul. 1985
Sung-won Park Jan. 1986 77 p
(Contract F29601-84-K-0045)
(AD-A165764; AFWL-TR-85-102) Avail: NTIS HC A05/MF A01 CSCL 09/3

Two kinds of pole estimators for given noisy transient data are presented. One is a SVD-based method and the other is the iterative preprocessing algorithm (IPA). The SVD method estimates the characteristic equation coefficients from the weakest eigenvectors when the system order is overdetermined. The IPA is shown to converge to the maximum-likelihood estimator for some range of SNR. It not only reduces the computational burden of the currently existing iterative algorithms but also improves stability. The approximate IPA (AIPA), which further reduces the computational burden, is described. The Cramer-Rao lower bound for the system characteristic equation coefficients is calculated. The IPA is extended to pole estimation for given multiple data sets. This technique is applied to estimating the natural frequencies of an electromagnetic scatter. An iterative scheme is described for estimating other parameters of the singularity expansion method (SEM) formalism. GRA

N86-28329# Battelle Columbus Labs., Ohio.
EXTENDED ABSTRACTS: SEVENTH BATTERY AND ELECTROCHEMICAL CONTRACTORS' CONFERENCE
D. Sheppard, comp. and J. Hurwitch, comp. Nov. 1985 329 p Presented at the Annual Battery and Electrochemical Energy Storage Contractors' Meeting, Washington, D.C., 18 Nov. 1985 Prepared in cooperation with Pacific Northwest Labs., Richland, Wash.
(Contract DE-AC06-76RL-01830)
(DE86-003019; CONF-851146-Absts) Avail: NTIS HC A15/MF A01

Seventy-two papers presented at the Seventh Battery and Electrochemical Contractors' Conference are arranged under the following session headings: EPRI storage program, review of key program activities, sodium/sulfur battery development, advanced battery research (two sessions), flow battery development, sodium/sulfur battery research, systems analysis and technology transfer, performance and testing (two sessions), flow battery research, metal/air batteries, and fuel cells. DOE

N86-28330# Lawrence Livermore National Lab., Calif.
ALUMINUM-AIR POWER CELL: THE M4-CELL ASSEMBLY AND INITIAL TESTS
A. Maimoni, S. A. Muelder, and W. C. Hui 3 Oct. 1985 46 p
(Contract W-7405-eng-48)
(DE86-003182; UCID-20495) Avail: NTIS HC A03/MF A01

We fabricated, assembled, and tested the modular, wedge-shaped M4 Aluminum-Air Power Cell in a system with a fluidized-bed crystallizer and hydrocyclone separator. Two M4-cell experiments validated the design premises and indicated predictable performance. The combined duration of the M4-1 and M4-2 experiments was almost 9 h. Conductive epoxy bonds are inadequate for bonding the air-cathode metal screen to current collectors; soldered joints using low melting (93°C) Indium solder performed satisfactorily. Both experiments were terminated because of problems directly traceable to metallic tin deposited by the stannate corrosion inhibitor. Apart from problems caused by metallic tin, the M4-2 test system performed very satisfactorily. Individual cell pods are readily assembled into single or multicell stacks; it is easy to disassemble the cells after a run to determine cell condition. Air-cathode assembly is the most cumbersome aspect of the M4 cell. We obtained valuable information regarding the evolution of particle-size distribution. We did not observe substantial agglomeration of the smaller crystals. A simple model of secondary nucleation gave a reasonably good fit to the secondary nucleation observed in the M3-3 experiment. DOE

N86-28331# Sandia National Labs., Albuquerque, N. Mex.
EXPLORATORY BATTERY TECHNOLOGY DEVELOPMENT AND TESTING REPORT FOR 1984
N. J. Magnani, R. P. Clark, D. M. Bush, P. C. Butler, J. L. Chamberlin, J. M. Freese, K. R. Grothaus, K. D. Murphy, and P. E. Shoemaker Oct. 1985 97 p
(Contract DE-AC04-76DP-00789)
(DE86-003188; SAND-85-1446) Avail: NTIS HC A05/MF A01

Sandia National Laboratories, Albuquerque, has been designated as Lead Center for the Exploratory Battery Technology Development and Testing Project, which is sponsored by the US Department of Energy's Office of Energy Storage and Distribution. In this capacity, Sandia is responsible for the engineering development of advanced rechargeable batteries for both mobile and stationary energy storage applications. This report details the technical achievements realized in pursuit of the Lead Center's goals during calendar year 1984. DOE

N86-28332# Argonne National Lab., Ill.
TESTING AND DEVELOPMENT OF ELECTRIC VEHICLE BATTERIES FOR EPRI ELECTRIC TRANSPORTATION PROGRAM Technical Report, Nov. 1982 - Dec. 1984
Nov. 1985 106 p
(Contract W-31-109-eng-38)
(DE86-004178; ANL/OEPM-85-4) Avail: NTIS HC A06/MF A01

Argonne National Laboratory conducted an electric-vehicle battery testing and development program for the Electric Power Research Institute. As part of this program, eighteen battery modules previously developed by Johnson Controls, Inc. were tested. This type of battery (EV-2300 - an improved state-of-the-art lead-acid battery) was designed specifically for improved performance, range, and life in electric vehicles. In order to obtain necessary performance data, the batteries were tested under various duty cycles typical of normal service. This program, supported by the Electric Power Research Institute, consisted of three tasks: determination of the effect of cycle life vs peak power and rest period, determination of the impact of charge method on cycle life, and evaluation of the EV-2300 battery system. Two supporting studies were also carried out: one on thermal management of electric-vehicle batteries and one on enhanced utilization of active material in lead-acid batteries. DOE

N86-28333# Oak Ridge National Lab., Tenn.
IFSMTF EXPERIENCES AND CONCLUSIONS REGARDING THE USE OF KAPTON INSULATED, HIGH-VOLTAGE CABLE IN A VACUUM/CRYOGENIC ENVIRONMENT
C. T. Wilson, Jr., J. N. Luton, Jr., and S. S. Shen 1985 3 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003808; CONF-851102-46) Avail: NTIS HC A02/MF A01

This paper describes the experiences of the International Fusion Superconducting Magnet Test Facility (IFSMTF), formerly called the Large Coil Test Facility, with regard to the use of Kapton insulated cable for high-voltage instrumentation within the IFSMTF vacuum vessel. Initial high-performance tests performed on the General Dynamics electrical system were disappointing and led to the philosophy and technology associated with the use of Kapton insulated cable. DOE

N86-28334# Zeiss (Carl), Oberkochen (West Germany). Instrumentenbererich Entwicklung elektronenoptisch
ELECTRON GUN Final Report, Mar. 1983
Dieter Kurz Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 46 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-144; ISSN-0340-7608; ESA-86-96896) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.50

A 100 kV electron gun with field emission electrode for analytical electron microscopy was improved. A tetrode concept was used to obtain brightness values of 100 million to 1 billion A/sq cm. Using a ceramic insulator, safe control of the accelerating voltage without misdischarges is assured. The basis for routine and automated operation of the gun is provided by the use of integrated electronics at high voltage; safe protection of these modules in the case of discharges; and protective measures for the sensitive field emission tungsten cathode tip. Results show a brightness of three orders of magnitude higher than that of thermal systems. ESA

N86-28335# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
HOW TO PROTECT HARDENED FACILITIES FROM VERY HIGH LEVEL TRANSIENTS INDUCED ON POWER LINES BY LIGHTNING OR EMP
G. Perroton 1986 5 p Presented at Intern. Symp. on Electromagnetic Compatibility, Wakefield, Mass., 20-22 Aug. 1985
(SNIAS-861-422-105; ESA-86-97162) Avail: NTIS HC A02/MF A01

It is shown that in very severe environments due to lightning or EMP, classical protection devices with arresters may not be sufficient. Three systems are described: an insulating shaft system; a hydraulic system; and a fast circuit shorter. The first two systems are relatively independent of the specification of the threat and do not need to calculate the precise characteristics of the transients. The last device has the advantage of giving significant improvement of an existing protection. ESA

N86-28336# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
DESCRIPTION OF AN ELECTRONIC EQUIPMENT FOR THE BOFORS JOYSTICK [BESKRIVNING AV ELEKTRONIK TILL BOFORS STYRSPAK]
Lars A. Lekzen Jan. 1986 16 p In SWEDISH; ENGLISH summary
(FOA-C-20593-E3; ISSN-0347-3694; ESA-86-97034) Avail: NTIS HC A02/MF A01

The electronic unit supplies power to the joystick which has two detection (N-S and E-W) axes, and also handles the output signals from the joystick and transforms them to analog signals suitable for an A/D converter for further computerized treatment. An effect oscillator was built, giving a maximum voltage of 8 V. As the Bofors stick requires a feeding at 24 V, 400 Hz, a transformer must be used. The differential voltages from the stick are brought to the phase demodulators, one for each detection axe. ESA

N86-28337# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Avionics Panel.
THE IMPACT OF VERY HIGH PERFORMANCE INTEGRATED CIRCUITS ON RADAR, GUIDANCE AND AVIONICS SYSTEMS
Loughton, England Aug. 1985 396 p In ENGLISH and FRENCH Symposium held in Lisbon, Portugal, 20-25 May 1985
(AGARD-CP-380; ISBN-92-835-0379-1) Avail: NTIS HC A17/MF A01

Advances with silicon integrated circuit technology have demonstrated the feasibility of very large scale integration with gate densities of 10 to the 5th power/sq cm and with functional throughput rates in excess of 10 to the 12th power gate Hz/sq cm. These advances offer the prospect of compact, low power consumption, high throughput processors in a wide variety of roles throughout military electronic systems. This symposium aimed to involve integrated circuit experts who reviewed ththeir current and projected capabilities, circuit and subsystems designers who are exploiting the technology in implementing sophisted processing and data manipulation techniques and who reported on their progress, and system designers who described applications addressed by the advancing technology. For individual titles, see N86-28338 through N86-28374.

N86-28338# Naval Research Lab., Washington, D. C.
VHSIC TODAY AND TOMORROW
David O. Patterson and E. D. Maynard, Jr. (Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.) *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 4 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

The origin and objectives of the U.S. Department of Defense Very High Speed Integrated Circuits (VHSIC) Program are discussed. This document describes the several phases of the program schedule and give the status of each. The phase 1 contractors, their approaches, and highlights of the Phase 1 chip sets are given. Supporting programs ranging from design and fabrication to implementation are presented. The contractors of the Phases 2 submicron technology effort are listed with their projected results. Finally the technology insertion effort is discussed, listing some systems being implemented and the payoffs of the VHSIC program. Author

N86-28339# Department of Trade and Industry, London (England). Alvey Directorate.
VHPIC AND THE UK ALVEY PROGRAMME
W. Fawcett *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 3 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Very high performance silicon integrated circuits (VHPIC) will be vital to future defense systems. In the UK, the required technology is being developed in the Alvey program and will be exploited in a Ministry of Defense VHPIC application demonstrator program. The organization and objectives of these programs are described in this paper. Author

N86-28340# Ferranti Electronics Ltd., Oldham (England).
BIPOLAR VLSI TECHNOLOGY
D. L. Grundy *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 14 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

The fundamental aspects of speed, power dissipation, linear capability, nuclear radiation tolerance and manufacturability are discussed for bipolar VLSI technology. Ultimate speed limits for VLSI technology are considered. It is suggested that bipolar technology may ultimately prove to offer the lowest power dissipation for a given speed. Of increasing interest to users of VLSI chips is linear capability and the fundamental factors

influencing linear performance. The performance of bipolar technology in the nuclear environment is discussed. MOST and bipolar technologies are compared. Finally, the practical ultimate limits of complexity for VLSI chips are discussed and the problems associated with achieving acceptable manufacturing yields are explored. Author

N86-28341# TRW Electronics and Defense Sector, Redondo Beach, Calif. Microelectronics Center.
THE FUTURE OF BIPOLAR TECHNOLOGY FOR AVIONICS
Barry Dunbridge *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 10 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

In the past 25 years, silicon integrated circuit (IC) device technology has been heavily utilized in military and avionics systems due to primary advantages in availability, versatility, environmental ruggedness/reliability, and speed/frequency performance. Silicon n-channel metal oxide semiconductor (NMOS) technology has also rapidly developed and has been dominant for commercial applications due to its previous advantages of cost and density in modest environments, especially for standard memory and microprocessor functions. Complementary metal oxide semiconductor (CMOS) LSI/VLSI has more recently rapidly emerged as the dominant MOS device technology of the future. The long held speed performance advantage of silicon bipolar ICS is also being challenged by the superior switching speed of GaAs field-effect transistor (FET) ICs. The question arises as to the future competitiveness and role of silicon bipolar. The question is further examined in this paper, especially for future avionics systems applications having heavy realtime digital signal processing requirements. B.W.

N86-28342# Ruhr Univ., Bochum (West Germany). Inst. fuer Elektronik.
MONOLITHIC SILICON BIPOLAR CIRCUITS FOR GIGABIT APPLICATIONS
U. Langmann *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 4 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

This contribution presents examples of Si gigabit circuits for application in wide-band communication systems. Circuits recently implemented in a relatively conventional Si bipolar technology are reported and guidelines for the design of high-speed bipolar ICs are given. Performance data are compared to those of bipolar ICs using self-aligned process technologies. Author

N86-28343# Hughes Aircraft Co., El Segundo, Calif. Technology Dept.
HIGH LEVERAGE GaAs INTEGRATED CIRCUITS FOR MILITARY SYSTEMS
John T. Mendel *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 15 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

During the past fifteen years a substantial amount of funding has been devoted to the research and development of GaAs devices and circuits primarily by the space and military sectors of the U.S. Government. The remarkable characteristics of this compound semiconductor in terms of speed, radiation hardness, and the potential for low power consumption has caused many investigators to regard GaAS as a successor to silicon in high performance circuits for military applications. In spite of this promise there exists today very little usage of GaAs in military systems with the exception of discrete microwave FETs and IMPATT diodes. Fundamental problems of material growth and processing technologies have created formidable barriers to the rapid exploitation of the III-V compounds except at levels of small scale integration. However, for very demanding military applications GaAs still remains the basic hope for the future. Particularly in the area of preprocessing for radar and EW systems the speed requirements are well beyond the capabilities of silicon. The unique capabilities of GaAs devices are discussed and their continued use in military applications is highlighted. Author

N86-28344# Sandia National Labs., Albuquerque, N. Mex.
A COMPARISON OF THE RADIATION HARDNESS OF VARIOUS VLSI TECHNOLOGIES FOR DEFENSE APPLICATIONS
C. F. Gibbon *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 8 p Previously announced as N85-30236 (For primary document see N86-28337 19-33)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A17/MF A01

In this review the radiation hardness of various potential very large scale (VLSI) IC technologies is evaluated. IC scaling produces several countervailing trends. Reducing vertical dimensions tends to increase total dose hardness, while reducing lateral feature sizes may increase susceptibility to transient radiation effects. It is concluded that during the next decade at least, silicon complimentary MOS (CMOS), perhaps on an insulating substrate (SOI) will be the technology of choice for VLSI in defense systems. Author

N86-28345# Rome Air Development Center, Hanscom AFB, Mass. Solid State Sciences Div.
THE IMPACT OF VLSI ON INTEGRATED CIRCUIT RADIATION HARDNESS
Bobby L. Buchanan *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 12 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

The important constituents of energetic radiation and the effects of the radiation on semiconductor devices and integrated circuits are briefly summarized. The basic silicon material and device parameters which are sensitive to energetic radiation and can be controlled by the IC designer are delineated. The trends of the variation of hardness with the level of integration for commercial MOS and bipolar integrated circuits are examined. It is shown theoretically how the hardness will vary as a function of device size for total ionizing dose, ionizing dose rate, and single particle (cosmic ray) environments. Contrary to what the trends had been indicating, it is shown that the basic component devices theoretically and actually become more radiation resistant as the devices are scaled down in size for implementing higher levels of integration. However, the parasitic MOS and bipolar devices created in implementing VLSI designs may cause the overall hardness to decrease. The reasons for the radiation hardness of the GaAs integrated circuits are discussed and put into perspective with the silicon technology. Author

N86-28346# Plessey Co. Ltd., Romsey (England).
HARDWARE AND ARCHITECTURE DESIGN OF VLSI SYSTEMS
Brian G. Marchent and David F. Burrows *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 11 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

An outline of a design methodology is presented. This methodology enables the system designer to capitalize upon the opportunities offered by advances in digital semiconductor technology without being overwhelmed by the VLSI complexity management problem. The paper commences with a brief description of a typical enabling technology, in this case Plessey Megacell. Then the areas to which this technology can be applied are suggested and illustrated by reference to a Radar System. A large gap is shown to exist in terms of complexity between the basic building blocks of a VLSI device and the sub systems into which a Radar is typically decomposed in the first attempt at design partitioning. In order to be able to put the Radar system onto VLSI, a structured, hierarchical approach is shown to be necessary. The building blocks of each stage in the design process are proposed and finally the design task itself is described which,

at the lower level in the sub system design process, will consist of the structured instantation, parameterization and interconnection of the hierarchical building blocks. Author

N86-28347# Rome Air Development Center, Griffiss AFB, N.Y. Reliability and Compatibility Div.

THE USE OF FAULT TOLERANT AND TESTABLE HIGH PERFORMANCE INTEGRATED CIRCUITS FOR IMPROVED MILITARY ELECTRONIC SYSTEM AVAILABILITY

John J. Bart *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 4 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

The rapid evolution of high performance Very Large Scale Integrated Circuits (VLSICs) has resulted in accelerated opportunities for improving the operational performance of military electronic systems. In addition, the microelectronics technology base also holds the promise of providing improvements in the operational availability, survivability and logistics supportability of these complex systems. The basics for these advances lies in the ability to design microelectronics based systems which are much more fault tolerant and more easily testable than those which have been developed to date. The current activities in the design of testable/fault tolerant integrated circuits are reviewed and areas for future emphasis are suggested. Author

N86-28348# Electronique Serge Dassault, St. Cloud (France).

VLSI CONTROL STRUCTURES [STRUCTURES DE CONTROLE DANS LES V.L.S.I.]

G. Vallas *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 12 p In FRENCH; ENGLISH summary (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

After some illustrated examples of the technological progress made in the past 30 years, this report shows the objectives for VLSI technology in the future, particularly for military applications (radar and homing devices) as well as the control of these circuits. The objectives for VLSI technology research are shown to include: satisfying the needs for the 90's; using suitable technology to reduce the cost; and increasing the efficiency by using appropriate system architecture. Author

N86-28349# Rensselaer Polytechnic Inst., Troy, N.Y. Center for Integrated Electronics.

GALLIUM ARSENIDE WAFER SCALE INTEGRATION

J. F. McDonald, G. Taylor, R. Steinvorth, B. Donlan, and A. S. Bergendahl *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 14 p Sponsored in part by the Fannie and John Hertz Foundation, and by IBM VLSI Fellowship (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

Gallium Arsenide (GaAs) digital MESFET technology has recently begun to appear in the semiconductor marketplace. The initial commercial offerings are at the small to medium scale integration levels. The high speed of these parts would seem to be very attractive for designers of high performance signal processing equipment. Persistent yield problems, however, have prevented the appearance of large scale integrated circuits. As a result, intrapackage and interpackage signal propagation problems such as coupling, parasitics and delay are likely to negate much of the benefits of the fast MESFET logic devices for large systems constructed with such small scale building blocks. An early packaging concept, Wafer Scale Integration (WSI), which could possibly be used to address some of these limitations is reexamined. Author

N86-28350# Kaiserslautern Univ. (West Germany). Lehrstuhl fuer Grundlagen der Elektrotechnik.

DIGITAL CORRELATION PROCESSORS FOR SPREAD-SPECTRUM-COMMUNICATION-SYSTEMS c32

Hans-Joachim Fischer and A. Baier *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 10 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

Some important correlators are presented and examined with respect to their applicability in spread-spectrum systems. The most suitable correlators are SAW TDL Filters, SAW Convolvers and Digital Matched Filters. The SAW devices have good performance and need only little space. Digital devices are easy to handle but hitherto suffer from a compromise between signal width, signal length and correlation rate. Nevertheless digital correlators are of great interest considering the advances in semiconductor technology. Two compact Digital Matched Filters for binary reference signals are presented, which show the possibilities of quantized recieved signals. The first DMF, called 4-phase DMF, is used for binarily quantized recieved signals. The second DMF can process received signals, which are quantized much finer. Author

N86-28351# Defence Research Establishment, Ottawa. (Ontario).

A HIGH PERFORMANCE CHIP SET IMPLEMENTATION OF A FINITE IMPULSE RESPONSE FILTER

R. J. Inkol, K. D. Symons, and P. D. Clarke *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 12 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

The systolic properties of digital signal processing algorithms can most easily be exploited by specialized processors with simple architectures providing considerable parallelism and freedom from bottlenecks in the control and flow of data. The realization of such processors is facilitated by the availability of advanced IC process technologies, coupled with Computer Aided Design (CAD) techniques. A design example for a Finite Impulse Response (FIR) filter is presented. It consists of a small chip set; a multiplier-accumulator, a coefficient memory (consisting of Read Only Memory (ROM) or Random Access Memory (RAM) devices) and a Data Memory/Control Unit (DMCU). The latter, implemented with standard cell techniques, includes a 128 word x 16-bit data memory, generates all system control signals from a few simple external signals, and provides a simple asynchronous interface. The basis design concept is well suited for implementation using advanced technologies. Sub-micron silicon technology would provide improved performance and facilitate a single chip implementation, while gallium arsenide technology offers potential for real-time video signal processing. y would provide improved performance and facilitate a single chip implementation, while gallium arsenide technology offers potential for real-time video signal processing. Author

N86-28352# AEG-Telefunken, Ulm (West Germany). Radar Div.

RADAR SIGNAL PROCESSING WITH HIGH SPEED LSI DEVICES

P. K. Schmitt *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 10 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

The basic structures of digital processing architectures using fast dedicated VLSI components are shown for two typical coherent signal processing operations: pulse compression and Doppler filtering. It is shown how these can be realized using currently available VLSI components and how future, more highly integrated components could be derived. A key role here is played by chips which perform fast multiplication of complex number pairs. Author

N86-28353# Physics and Electronics Lab. TNO, The Hague (Netherlands).

REAL-TIME DIGITAL MATCHED FILTER FOR RADAR PULSE COMPRESSION c32

J. Wiltschut and G. A. Breems *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 8 p (For primary document see

N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Digital processing of radar signals becomes more feasible by the advances in integrated circuit technology. A programmable matched filter for real-time compression of frequency modulated radar pulses, implemented with high speed LSI/MSI circuits is described. This matched filter, denoted as pulse compressor, forms part of an experimental radar system. The input signal consists of complex samples (2*12 bits) at a 10 MHz rate. The maximum pulse duration is 25 micro-seconds, which results in a time-bandwidth product of 250. The pulse compression is achieved through application of fast convolution with a transform size of 512 and a 50 percent overlap. The pulse compressor has a pipelined structure consisting of similar modules. The data is in 12 bit fixed point format and processing is done by integer arithmetic with block floating point scaling to avoid overflow. The internal data throughput rate is 20 MHz and more than 720 million multiplications per second are executed. Author

N86-28354# AEG-Telefunken, Ulm (West Germany).
MONOLITHIC 6 BIT SUBCONVERTER FOR HIGH SPEED, HIGH RESOLUTION A/D CONVERSION SYSTEMS
F. Beck and G. Bergmann *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 5 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

The design of a subconverter for sequential flash A/D converters is presented. The subconverter consists of a 6 bit flash ADC, 64 pipeline latches, a 6 bit (64 current sources) D/A converter and 6 bit data register. It was integrated on a single die utilizing a high speed bipolar process with double layer metallization. Circuit details, simulation results, and chip design are described. Author

N86-28355# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
HIGH SPEED DIGITAL IMAGE PROCESSING FUNCTIONS FOR A REALTIME SYNTHETIC APERTURE RADAR PROCESSOR c32
Roland Schotter and Horst Froelich *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 6 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Realtime Synthetic Aperture Radar Processing requires high speed implementation of basic image processing functions such as Lowpass/Bandpass Filtering, Correlation/Convolution, Fourier Transformation, Imaging Memories, Interpolation/Resampling, Complex Multiplication/Accummulation and Processing Control. The hardware concept is based on modular processing units which allow the construction of different algorithms by simply combining the appropriate modules of the processing family in a pipeline structure. Each module is designed by taking advantage of the most advanced integrated digital circuits like fast multiplier/accummulators, ALS TTL and High speed CMOS control logic, 64 K/256 K dynamic memories, fast CMOS memories and integrated signal processors. The basic architecture of some of the processing modules (FIR-Filter, Image Memory, FFT/IFFT) will be presented together with the practical results in terms of operational speed, work length, power consumption and board sizes. Additionally, the structure of the realtime SAR Processor based on these processing functions are discussed in detail showing the flexibility of the hardware approach. Author

N86-28356# Standard Telecommunication Labs. Ltd., Harlow (England).
A SYSTOLIC ARRAY FOR HIGH PERFORMANCE ADAPTIVE BEAMFORMING c32
C. R. Ward and P. J. Hargrave *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 6 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

A new technique for adaptive antenna beamforming is described which provides very rapid adaptation. The technique avoids the explicit computation of the covariance matrix estimate and this results in a reduced sensitivity to limited arithmetic precision. The proposed algorithm may be implemented in an efficient pipeline architecture using a triangular systolic array. Author

N86-28357# Communications Research Centre, Ottawa (Ontario).
PROCESSING REQUIREMENTS FOR RADAR DIGITAL BEAMFORMING c32
J. Litva *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 16 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

An overview is given of the signal processing capabilities of radar DBF systems. Also, a description is given of advances required in existing hardware for implementing real-time signal processing on radar DBF systems. These include antenna elements, monolithic microwave integrated circuits and VLSI. A discussion is given of the advantages of novel architectures, such as systolic arrays or hypercubes using up to 10,000 processing elements. It is shown that the processing for a DBF system follows naturally from a set of basic matrix operations, running from matrix-vector multiplications to singular value decomposition of matrices and that these functions are best implemented using systolic-array type architectures. Finally, results will be presented from an existing near real-time DBF system which is capable of carrying out a 16-point complex FFT in 250 nanoseconds and produces 64 independent radar-beams in 4 microseconds. Author

N86-28358# Norwegian Defence Research Establishment, Kjeller.
TWO-LEVEL DATA-FLOW ARCHITECTURE FOR PROGRAMMABLE SIGNAL PROCESSING c60
Yngvar Lundh and Oddvar Sorasen *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 10 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Signal processing tasks such as those encountered in radar systems can be highly demanding in terms of computer instructions per second. A multiprocessor architecture called Martinus is described, exploiting complexity to achieve high performance. Complex VLSI circuits are being specially designed for Martinus machines. A reconfigurable network consists of programmable processors, interconnected by buses of very high capacity. The processors may be of different types and can be of more or less task oriented design. One such class of types, Svop, is itself a multiprocessor, comprising a systolic array of programmable processing elements. Martinus-machines can be configured for high capacity. A 120 MIPS machine is in operation. Further developments aim to make capacities beyond 1 GFLOPS practical. The development comprises several application-specific integrated circuits including a bus circuit offering data transmission rates up to 2.5 Gbits/second. The article commences with a discussion of basic limiting factors of high performance computing. Author

N86-28359# Royal Signals and Radar Establishment, Malvern (England).
MIL-DAP: ITS ARCHITECTURE AND ROLE AS A REAL TIME AIRBORNE DIGITAL SIGNAL PROCESSOR c60
P. Simpson, J. B. G. Roberts, and B. C. Merrifield *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 18 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Prototypes of a highly programmable digital processor, Mil-DAP, operating in excess of 300 MOPS and occupying less than a cubic foot will be available in 1985. Its architecture consisting of a large array of processing elements, controlled by a single control unit operating in a Single Instruction Muliple Data (SIMD) mode is described in some detail, including the provision of fast data input-output (up to 40 MBytes/sec), data buffering and programmable data reformation such as corner turning. Two programming

languages exist; an assembler language for high efficiency and a higher level parallel form of FORTRAN. The ease of use of both these parallel languages is demonstrated with reference to simple examples. Mil-DAP's performance, size, weight and power consumption suit it well to the wide range of applications encountered in an avionics environment. For example, multimode, radar signal processing incorporating spectral analysis, constant false alarm rate processing and ambiguity resolution; speech recognition as in a voice driven cockpit; electronic support measures where very high speed association and recognition of received pulse information is needed; and reconnaissance image processing, are all potential real time applications. Benchmarks for these are given.
Author

N86-28360# Tridex Systems, Inc., Nepean (Ontario).
A DISTRIBUTED ARRAY SIGNAL PROCESSOR WITH FAULT-TOLERANCE ATTRIBUTES **c60**
E. T. Fathi, C. V. W. Armstrong, K. Q. T. Nguyen, and A. W. Bridgewater (Department of Communications, Ottawa, Ontario) *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 15 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

A fault-tolerant distributed array signal processor designed as a research tool to investigate fault-tolerance in the area of space-based radar signal processing is described here. Such applications require high reliability due to the closed system environment and high performance in order to reduce the bandwidth in data communication. These requirements exceed those required by commercial systems. The system described here is a multiple microprocessor-based system configured as a 3*3 array of identical processing modules. Each module consists of a data and communication subsystem and a signal processing subsystem, employing off-the-shelf state-of-the-art VLSI technology. Each subsystem has its own microprocessor, local program and data memory and operates independently to each other. The two subsystems operate asynchronously and also perform confidence tests on each other's performance. Communication between the processing modules is parallel at high data rates using dedicated DMA channels. A powerful virtual token-passing mechanism manages the arbitration for the parallel busses. The operating system is fully distributed and provides dynamic load sharing.
Author

N86-28361# Mitre Corp., Bedford, Mass.
A REVOLUTIONARY DESIGN METHOD FOR VLSI SIGNAL PROCESSORS
Ronald D. Haggarty, Bruce L. Johnson, and Edward A. Palo *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 12 p Sponsored in part by Mitre Corp., Bedford, Mass. (For primary document see N86-28337 19-33)
(Contract F19628-84-C-0001)
Avail: NTIS HC A17/MF A01

This paper presents a new method of designing digital signal processors for very large scale integrated (VLSI) circuit implementation with residue number systems (RNS), as opposed to the binary number systems traditionally used. In an RNS, a number is represented by its residues, modulo a set of relatively prime integers. The basic operations of modulo addition and multiplication are simpler in RNS because they can be executed independently in each residue class. Consequently, a desired linear function can be executed in a set of parallel channels on a chip, where each channel performs the same calculation modulo the integer used in theat channel. Complexity is thus reduced by two mechanisms. Interconnections between parallel channels are eliminated and all operations are performed modulo the small integer used in each parallel channel of the RNS structure. The square law of circuit complexity applied to this set of small integers results in small, simple circuits. Speed of computation is increased because carry propagation delays are avoided. Further, the RNS design is combined with systolic arrays in such a way that the desired function becomes a parallel set of nearest neighbor--connected identical cells, each of which is minimally complex. The regularity minimizes interconnections and design time--only one master VLSI macrocell that can be optimized and replicated under computer-aided design (CAD) control is needed. In addition, two levels of redundancy can readily be incorporated to achieve concurrent test and fault tolerance: (1) redundant parallel residue channels can be used, and (2) error detection techniques can be efficiently incorporated into each of the systolic array cells that compose the parallel RNS channels.
Author

N86-28362# Hughes Aircraft Co., Canoga Park, Calif.
POTENTIAL IMPACT OF VLSI TECHNOLOGIES ON GUIDED MISSILE DESIGN
Hans A. Maurer and Knut S. Kongelbeck *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 6 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Some aspects of the anticipated impact of emerging VLSI technologies on tactical missiles, present and future generations are discussed. VLSI evolution represents a unique example of a very dynamic and pervasive trend in commercial and military applications. It is our opinion, however, that the characteristics of this trend are quite different in tactical missiles, not only compared to commercial electronics but even to strategic or space missiles. Considering the particular objectives and constraints as they seem common to most tactical guided missiles and smart munitions, the VLSI technologies should be almost tailored to this application. However, there are some perequisites to be considered to make the introduction of VLSIs successful. Here are some examples: careful planning to be in step with the maturity of the VLSI technology, sensible selection of targets for insertion or new designs and - quite importantly - consideration of program stability in terms of volume, rates, and changes. From a technical viewpoint alone, the current trend to light and small, 4- to 8-inch-diameter configuration whether ground or air-launched encourages an early insertion of VLSIs. Electronic packaging with unusual form factors, e.g., having a central hole for warhead effectiveness, high density and low weight, and low power dissipation, poses conflicting requirements to the missile designer. With very few exceptions, such as in magnetics or battery chemistry, the electronics sections cannot benefit from other technological breakthroughs. It is the evolution of monolithic large scale integration of circuits on Silicon and to a lesser degree on Gallium Arsenide which bears the main load to meeting these criteria of processing density at minimum power dissipation, and of providing an ever-increasing functional throughput. Those VLSI embodiments which appear to be most likely to influence missile electronics are defined. They may be divided into four categories, with some ranking indicated regarding their maturity and avaliability, as well as nonrecurring cost weight: (1) Memories (RAM and ROM); (2) Catalog special devices (ADC, DAC, (CP); (3) Semicustom (CGAs); and (4) Full custom. Author

N86-28363# AEG-Telefunken, Ulm (West Germany). Design Center for Integrated Circuits.
CHARGE PROCESSING IN INFRARED CCD-SENSOR-ARRAYS
G. Kohlbacher and P. Nothaft *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 7 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Caused by the rapid progress in solid state technologies, especially in the field of VLSI components, infrared thermal imaging is more and more attractive for a lot of military applications. Tactical missile systems, target aquisition, fire control, airborne threat warning, airborne reconnaissance and spaceborne surveillance besides tank-mounted or man-portable night-vision cameras are important examples for military systems with infrared sensor-arrays. The physical principles of infrared detectors witha sufficient sensitivity and resolution demand an operating temperature in the range of liquid nitrogen, i.e., about 77 K. Due to the low operating temperatures MOS technologies are the best choice for the multiplexer circuits. The system designers need together with the

multiplexer function the ability to integrate the individual detector signals during one frame period. These two functions may be easily combined in Charge Coupled Devices (CCD) and therefore for the most IR sensor-arrays described in the literature CCDs had been used. A CCD is an analog delay line where signals are handles as charge packets, which will be clocked through an arrangement of MOS capacitors. Two methods packets, which will be clocked through an arrangement of MOS capacitors. Two methods of detector-CCD coupling are described. A novel design of a monocithic 32x32 element array with Si:In detectors sensitive in the 3-5 micron range at an operating temperature of 55 k is described. Author

N86-28364# British Aerospace Dynamics Group, Hatfield (England). Software Engineer.

THE IMPLEMENTATION OF IMAGE PROCESSING ALGORITHMS c60

D. A. Pellatt *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 8 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

The purpose of this paper is to describe a specific set of image processing problems, different classes of algorithms applicable to those problems and the efficient implementation of such algorithms using advanced processor architectures. The first section of the paper contains a brief description of the requirements of a typical image processing system operating in a particular scenario. The second section contains descriptions of various algorithms applicable to such a system; the techniques described having been selected in order to demonstrate the contrasting hardware requirements of different types of algorithms. The third, and final, section suggests ways in which the various algorithms may be implemented in Emerging Technology hardware. The applicability of systolic processors, reduction machines and data - flow architectures are discussed. Author

N86-28365# Texas Instruments, Inc., Lewisville.

MISSION BENEFITS OF A VERY HIGH THROUGHPUT IMAGE TRACKER SYSTEM c61

Joel K. McWilliams and Jack H. Pridgen *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 9 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

The launch and leave, air-to-ground, autonomous class of weapons with imaging sensors is considered. Processor throughput is coupled very closely to many areas of system design for this class of weapon. A typical weapon requires midcourse guidance and must search a relatively large uncertainity area by the time it is close enough to the target for reliable detection. The detection processing time is proportional to the number of pixels in the search area. One can alleviate the detection processing time by allowing the imager to have coarse resoltuion, but that is done at the expense of detection range. If the detection range is inadequate, the terminal accuracy will be degraded due to insufficient time for guidance. The situation is that processor throughput limits resolution for searching the uncertainty area, and resolution limits detection range. While increasing the number of resolution elements in a given search area is one way to use additional processor throughput, this paper considers a less obvious way to make use of higher throughput, which is reducting the size of the search area for the mission. This reduction is accomplished by using an imaging tracker system at the st art of midcourse to significantly reduce two of the contributors to the size of the uncertainty area. By using an image tracking system to track the ground immediately after launch, the actual attitude of the boresight with respect to horizontal and vertical can be determined with more precision than it could be by using airframe attitude and gimbal angle measurements. The better boresight reference effectively reduces the uncertainty in both the airframe attitude reference and the measurement of the platform position with respect to the airframe. The equations necessary to infer true horizontal and vertical from the ground tracking subimage motions are shown. A throughput analysis shows the level of throughput required to solve the equations. The accuracies to which the boresight angle can be measured by this method are shown. The method offers a double benefit, as the reduced search area allows more latitude in other system design trades concerning the use of increase throughput. Author

N86-28366# MATRA Espace, Paris-Velizy (France). Div. Equipements.

A FLOATING POINT PROCESSOR FOR MISSILE GUIDANCE

Francois Plisson and Alain Dantee *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 12 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

The results of the study for the definition of a new missile guidance, highly integrated processing unit are analysed. An overview of advanced algorithms and software architectures required is given, available technologies are reviewed and the rationale for building a dedicated processor is discussed. The design methodology using the standard cells approach is explained. Data processing needs for missile guidance have increased significantly over past years. These trends are confirmed for the new development, with the introduction of high speed, highly integrated digital circuits. Author

N86-28367# British Aerospace Dynamics Group, Hatfield (England). Dynamics Group.

NEW SYSTEM DESIGN METHODOLOGIES IN THE DESIGN OF MODERN IMAGING MISSILE SYSTEMS STIMULATED BY THE INTRODUCTION OF VLSI DEVELOPMENT TOOLS

A. Dent and G. Briant *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 16 p (For primary document see N86-28337 19-33)

Avail: NTIS HC A17/MF A01

There is a trend towards increasing complexity of modern missile systems, particularly with regard to the guidance algorithms that will be used in future imaging systems. In some applications the use of general purpose computing elements is prohibited because of performance requirements. In these cases dedicated hardware designs are necessary. Increasingly these designs are implemented in semi-custom LSI/VLSI technology. As the use of this type of approach increases there are consequences that propagate into the total missile system design philosophy. Some of the advantages and disadvantages of using these newer design techniques, based on experience gained in the design of advanced imaging guidance systems, are discussed, in particular the architectures associated with image processing. The major advantages of a LSI/VLSI solution, whether a general purpose computing element or a dedicated hardware element are: (1) increased computational performance; (2) Reduced size; (3) Lower cost; (4) Reduced power consumption; and (5) greater reliability. For a one off type development system, and small scale production quantities, the cost of VLSI is always thought to be prohibitive. However, because of the computational performance required when implementing the complex algorithms associated with imaging guidance systems, the architectural advantages associated with VLSI become the dominant factor. For designs of this complexity it is argued that the cost and timescales involved for the LSI approach have significant advantages at the end of the development cycle provided that the appropriate design procedures are adopted. The requirements for a design procedure will be discussed for both the total missile system and the electronic subsystems. Author

N86-28368# Royal Signals and Radar Establishment, Malvern (England).

ADVANCED SIGNAL PROCESSING TECHNOLOGY FOR FUTURE RADAR SYSTEMS c32

C. Pell, A. C. Fairhead, and M. B. Thomas *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 15 p (For primary document

see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

This paper reviews and discusses the likely technology requirements of the signal processing functions of future radar systems. The technology considerations are largely confined to digital functions, starting at the analogue-to-digital interface. In order to focus the technology discussion, some of the candidate modes of operation of future radars are stated together with the key processing functions that need to be supported. The processing functions include adaptive array antenna processing and programmable digital pulse compression. Using these functions as examples, assessments have been made of the technology requirements and it is shown that both digital beamforming and digital pulse compression are particularly demanding of fast arithmetic operations such as complex multiplication. The advanced VLSI technology functions that are considered to be most important for future radar processing are discussed. Author

N86-28369# Thomson-CSF, Montrouge (France). Div. Equipements Avioniques.
THE APPLICATION OF HIGH-PERFORMANCE INTEGRATED CIRCUITS FOR AIRPORT FIRE CONTROL RADARS [INTERET DES CIRCUITS INTEGRES DE HAUTES PERFORMANCES POUR LES RADARS AEROPORTES DE CONDUITS DE TIR]
Jean-Claude Marchais *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 4 p In FRENCH; ENGLISH summary (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

The number of functional modes needed for airport fire control radars, together with the need for high-performance characteristics, indicates that high-performance integrated circuits will have significant applications in such radar. It is shown that multi-function and multi-mode radars which combine air-to-air combat, air-to-ground and air-to-sea modes will comprise the basis for the next generation of fire control radars. Other applications for such radars are shown to include anti-collision, air navigation and air-to-air pursuit modes. Author

N86-28370# Elektronik-System G.m.b.H., Munich (West Germany).
AN INTEGRATED APPROACH TOWARD RECOGNIZING, LOCATING AND COMBATING TARGETS FROM A MODERN INTERCEPTOR AIRCRAFT
E. G. Meyhoff and H. W. Kloeckner *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 16 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Interceptor aircraft of the future will find themselves in an environment which will not only be significantly more hostile than today but also far more difficult to assess. On the one hand the requirement will be to reduce the detectability of the own aircraft and on the other to enhance the capability of destroying enemy targets. Reduction of detectability can be achieved through a variety of measures such as lowering the radar cross section, the IR emission or the RF emission. Enhancement of the capability to destroy enemy target requires, next to better weapons, longer detection and identification ranges as well as quicker reaction times. Faster reaction times are not only required to gain advantages in combating the designated enemy targets but also to respond to threat situations which may emanate from sources other than the targets. The requirement will exist for an avionic system capable of correlating all relevant data and either reaching decisions itself or presenting the pilot with information in such a way that they support his own making process. This paper describes a typical set of aircraft equipments which would be involved in the data acquisition and decision making processes; it quantifies data volumes and rates and, based on these figures, attempts to define processing and correlation requirements. It then proposes a system architecture which might be suitable for the tasks at hand. The emphasis of the paper will be on assessing the impact of LSI/VHSIC technology on those portions of the avionics system which are utilized in the processes described above. Author

N86-28371# Aeritalia S.p.A., Caselle Torinese (Italy). Gruppo Sistemi Avionici ed Equipaggiamenti.
POSSIBLE IMPACTS OF VHSIC ON MIL-STD-1553B DATA TRANSMISSION MANAGEMENT
L. Berardi and M. Merlano *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 12 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

High performance integrated circuit technologies allow for dramatic improvement in speed and reduction in size of the integrated circuits. This fact results in the possibility to pack in a denser way the computing and decision making functions of the avionics systems. Nevertheless it is still necessary to connect together the various sytem components, spread through the airframe, by means of an interfunction data transmission system. For these reasons the application of the new technologies to a MIL-STD-1553B data transmission system is considered. In particular the data management task allocated to the Bus Controller is described in four increasing levels of complexity, ranging from the minimum requirement to an 'expert' function including an high degree of configurability. The performance obtainable by implementing the functions in the current or new technologies, and with two different architectural solutions, are measured or estimated. The comparison among the obtained results shows that the new technologies not only improve the performances of the data transmission system, but also allow to include an higher degree of intelligence in the function, extending in this way the application of MIL-STD-1553B to future advanced avionic systems. Author

N86-28372# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
THE IMPACT OF VHPIC ON AVIONIC SYSTEM ARCHITECTURE, PACKAGING AND MAINTAINABILITY
L. T. J. Salmon and D. E. Oldfield *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 5 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

The advent of high performance integrated circuit technology will have a far reaching effect on avionic systems. Currently, the impact is being mainly felt at a high bandwidth, signal processing level where the benefits are self-evident, however, unless the effect of the technology is considered across the whole of the avionic system then there is little doubt that much of the improved mission effectiveness promised by the new, high bandwidth systems will not accrue. A wider, system level approach is therefore needed which not only encompasses the technical aspects of individual sensors but also considers the remainder of the airborne data processing system and more traditional topics such as maintainability, packaging and architecture. This paper highlights some of the areas in which very high performance integrated circuits (VHPIC) could have a major impact on avionics systems and indicates some of the factors that will need to be considered during the design of future systems. Author

N86-28373# Westinghouse Electric Corp., Baltimore, Md. Advanced Technology Div.
THE IMPACT OF VERY HIGH PERFORMANCE INTEGRATED CIRCUITS ON AVIONICS SYSTEM READINESS
Gene Strull *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 2 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Very high performance integrated circuits (VHPIC) represent more than an integrated circuit technology advance- VHPIC really represents a new systems/technology culture. With a philosophy of top-down design and bottom-up build, a vehicle is provided to avoid rapid obsolescence so prevalent in the fast moving integrated circuit industry. However, to successfully and effectively design advanced systems in this manner, a design methodology is required that adequately addresses the challenge. Since everything from chip definition through application analysis is interactive with

everything else, the challenge is to adequately keep track of all the perimeters and their relationship. The methodology by which design and analysis are accomplished is discussed. The starting point is the systems architecture and its application software. From the architecture and application software the partitioning of the system into appropriate modules can be derived. From this an idea of the integrated circuits needed can be determined. The elements of system readiness are described. They are design, implementation, insertion, maintenance, and (Preplanned Product Improvement). Author

N86-28374# British Aerospace Aircraft Group, Woodford (England). Aircraft Group.
THE IMPACT OF ARTIFICIAL INTELLIGENCE ON AIRBORNE MARITIME RECONNAISSANCE
J. Shepard and R. J. Scott-Wilson *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 14 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

Some of the problems arising out of the introduction of VHPIC to the sensor and data processing systems of Maritime Reconnaissance aircraft are susceptible to solution by conventional computing techniques within mission time constraints. Some may be more susceptible to the use of artificial intelligence techniques. This paper identifies those aspects of artificial intelligence relevant to the Airborne Maritime Reconnaissance task and the areas of the current task where artificial intelligence can be usefully applied. It reviews the current state of the art in the relevant aspects of artificial intelligence and indicates how they might be employed in the near, medium and long term. It indicates some future applications and concludes that, artificial intelligence will play an important role in the future Maritime Reconnaissance aircraft. Author

N86-28282*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SYSTOLIC ARCHITECTURE FOR THE CORRELATION AND ACCUMULATION OF DIGITAL SEQUENCES
L. J. Deutsch and C. R. Lahmeyer *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 09C

N86-28430*# Systems Science and Software, La Jolla, Calif.
THEORY OF PLASMA CONTRACTORS FOR ELECTRODYNAMIC TETHERED SATELLITE SYSTEMS
Donald E. Parks and I. Katz *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings Volume 1 Jun. 1986 p 499-546 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-28375*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FEASIBILITY STUDY OF OPTICAL BOUNDARY LAYER TRANSITION DETECTION METHOD Final Report, 22 Feb. 1983 - 15 Nov. 1985
M. Azzazy, D. Modarress, and J. D. Trolinger Jun. 1986 179 p (Contract NAS1-17293)
(NASA-CR-178109; NAS 1.26:178109; SLD-85-2285-47F) Avail: NTIS HC A09/MF A01 CSCL 20D

A high sensitivity differential interferometer was developed to locate the region where the boundary layer flow undergoes transition from laminar to turbulent. Two laboratory experimental configurations were used to evaluate the performance of the interferometer: open shear layer, and low speed wind tunnel turbulent spot configuration. In each experiment, small temperature fluctuations were introduced as the signal source. Simultaneous cold wire measurements were compared with the interferometer data. The comparison shows that the interferometer is sensitive to very weak phase variations in the order of 0.001 the laser wavelength. An attempt to detect boundary layer transition over a flat plate at NASA-Langley Unitary Supersonic Wind Tunnel using the interferometer system was performed. The phase variations during boundary layer transition in the supersonic wind tunnel were beyond the minimum signal-to-noise level of the instrument. Author

N86-28376*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATION OF BOUNDARY LAYERS. PART 1: WEAK FORMULATION AND NUMERICAL METHOD
Philippe R. Spalart Feb. 1986 21 p
(NASA-TM-88222; A-86029; NAS 1.15:88222) Avail: NTIS HC A02/MF A01 CSCL 20D

A numerical method designed to solve the time-dependent, three-dimensional, incompressible Navier-Stokes equations in boundary layers is presented. The fluid domain is the half-space over a flat plate, and periodic conditions are applied in the horizontal directions. The discretization is spectral. The basis functions are divergence-free and a weak formulation of the momentum equation is used, which eliminates the pressure term. An exponential mapping and Jacobi polynomials are used in the semi-infinite direction, with the irrotational component receiving special treatment. Issues related to the accuracy, stability and efficiency of the method are discussed. Very fast convergence is demonstrated on some model problems with smooth solutions. The method has also been shown to accurately resolve the fine scales of transitional and turbulent boundary layers. Author

N86-28377*# Flow Research, Inc., Kent, Wash.
FEASIBILITY OF GENERATING AN ARTIFICIAL BURST IN A TURBULENT BOUNDARY LAYER
Mohamed Gad-el-Hak Washington NASA Aug. 1986 53 p (Contract NAS1-17951)
(NASA-CR-4003; NAS 1.26:4003; Rept-332) Avail: NTIS HC A04/MF A01 CSCL 20D

Artificial bursts were generated in laminar and turbulent boundary layers. The burst-like events were produced by withdrawing near-wall fluid from two minute holes separated in the spanwise direction or by pitching a miniature delta wing that was flush-mounted to the wall. Either of these actions generated streamwise vorticity and a low-speed streak that resembled a naturally occurring one. The resulting sequence of events occurred at a given location and at controlled times, allowing detailed examination and comparison with natural, random bursts by means of flow visualization and fast-response probe measurement techniques. Author

N86-28378*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFUSION FLAME EXTINCTION IN SLOW CONVENCTIVE FLOW UNDER MICROGRAVITY ENVIRONMENT
Chiun-Hsun Chen 1986 16 p Proposed for presentation at the Microgravity Fluid Mechanics Symposium, Anaheim, Calif., 10-11 Dec. 1986; sponsored by ASME
(NASA-TM-88799; E-3137; NAS 1.15:88799) Avail: NTIS HC A02/MF A01 CSCL 20D

A theoretical analysis is presented to study the extinction characteristics of a diffusion flame near the leading edge of a thin fuel plate in slow, forced convective flows in a microgravity environment. The mathematical model includes two-dimensional Navier-Stokes momentum, energy and species equations with one-step overall chemical reaction using second-order finite rate Arrhenius kinetics. Radiant heat loss on the fuel plate is applied in the model as it is the dominant mechanism for flame extinguishment in the small convective flow regime. A parametric study based on the variation of convective flow velocity, which varies

the Damkohler number (Da), and the surface radiant heat loss parameter (S) simultaneously, is given. An extinction limit is found in the regime of slow convective flow when the rate of radiant heat loss from fuel surface outweighs the rate of heat generation due to combustion. The transition from existent envelope flame to extinguishment consists of gradual flame contraction in the opposed flow direction together with flame temperature reduction as the convective flow velocity decreases continuously until the extinction limit is reached. A case of flame structure subjected to surface radiant heat loss is also presented and discussed. Author

N86-28379# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE SHORE SINGULARITY OF WATER-WAVE THEORY. PART 2. SMALL WAVES DON'T BREAK ON GENTLE BEACHES Technical Summary Report

R. E. Meyer Oct. 1985 27 p

(Contract DAAG29-80-C-0041; Grant NSF MCS-82-15064)

(AD-A163652; MRC-TSR-2873) Avail: NTIS HC A03/MF A01 CSCL 20/4

The model of gravitational surface waves on beaches of small slope formulated in and its mathematical theory are used to show how an incident-wave amplitude can be defined so that a bound on it guarantees solutions which respect the assumptions of the model everywhere and forever. The structure of those solutions far from shore is then compared with that predicted near shore by the classical, linear theory to remove the indeterminacies of both theories: Shore reflection is determined for the classical theory, and it is shown how the critical length scale and amplitude of the beach theory are related to the familiar wavelength and amplitude in deep water. These results indicate that the beach theory captures and elucidates the basic singularity structure underlying the shore behavior of gravitational surface waves. Author (GRA)

N86-28380# Oak Ridge National Lab., Tenn.

PREDICTION OF FLOW RATES THROUGH AN ORIFICE AT PRESSURES CORRESPONDING TO THE TRANSITION BETWEEN MOLECULAR AND ISENTROPIC FLOW

S. F. DeMuth and J. S. Watson 1985 15 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985 Prepared in cooperation with Tennessee Univ., Knoxville

(Contract DE-AC05-84OR-21400)

(DE86-004682; CONF-851174-24) Avail: NTIS HC A02/MF A01

A model of compressible flow through an orifice, in the region of transition from free molecular to isentropic expansion flow, has been developed and tested for accuracy. The transitional or slip regime is defined as the conditions where molecular interactions are too many for free molecular flow modeling, yet not great enough for isentropic expansion flow modeling. Due to a lack of literature establishing a well-accepted model for predicting transitional flow, it was felt such work would be beneficial. The model is nonlinear and cannot be satisfactorily linearized for a linear regression analysis. Consequently, a computer routine was developed which minimized the sum of the squares of the residual flow for the nonlinear model. The results indicate an average accuracy within 15% of the measured flow throughout the range of test conditions. Furthermore, the results of the regression analysis indicate that the transitional regime lies between Knudsen numbers of approximately 2 and 45. DOE

N86-28381# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THREE-DIMENSIONAL ROTATIONAL INVISCID FLOW CALCULATION IN AXIAL TURBINE BLADE ROWS

Tony Arts Sep. 1985 98 p

(VKI-TN-154; TUT-8502/TA/NT; ESA-86-97063) Avail: NTIS HC A05/MF A01

A method to compute three dimensional, rotational, adiabatic, inviscid flow of a perfect gas in an axial turbine blade row or an axial turbine stage (subsonic, transonic, or supersonic) is presented. In low subsonic, rotational flow calculations in isolated cascades, the method reveals the main secondary effects. Inside the passage, agreement between computed and measured static pressure and angle distributions is fairly good. For transonic flow calculations in axial turbine stages, the method uses a time-averaged blade row interaction model. The mass flow and the overall aerodynamic characteristics of both blade rows are well predicted. Real three dimensional effects, such as lack of stream surface axial symmetry, are clearly seen from the calculated results. Contrary to over an isolated blade row calculation, the interrow boundary conditions adapt themselves automatically to the flow pattern, no experimental data being built in to the calculation. ESA

N86-28382# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

CRITERIA FOR SEPARATION IN TWO-DIMENSIONAL STEADY AND UNSTEADY COMPRESSIBLE FLOW

Fuqing Zhang and Hans Foersching Sep. 1985 45 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-985)

(DFVLR-FB-85-60; ISSN-0171-1342; ESA-86-96880) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 16

Separation criteria for two-dimensional flows were deduced. The most important technical flow separation phenomena are reviewed, and the governing physical influence parameters are outlined. The starting points were the theory of viscous flow and Prandtl's boundary layer concept. The most important existing flow separation criteria are discussed. From a study of the streamline behavior near a separation point, generalized criteria for separation in two-dimensional steady and unsteady compressible flow are derived. It is shown that the existing criteria are special cases of the generalized criteria. ESA

N86-28383 Central Electricity Generating Board, London (England).

LOCAL CHARACTERISTICS OF HEAT TRANSFER AND FLOW DYNAMICS OF STAGGERED BANKS OF FINNED TUBES

A. Zhukauskas, R. Ulinskas, and F. Zinevicius 1985 18 p Transl. into ENGLISH from Trudy AN LitSSR (USSR), v. 2, no. 141, series B, 1984 p 40-45

(TI86-910130; BLL-CE-Trans-8152-(9022.09)) Copyright. Avail: Issuing Activity

Transverse flow around banks of finned tubes involving separation of the flow comes under the category of complex flows. In order to make an analytical study of such flows, for the purpose of optimizing the finning arrangement, it is necessary to carry out structure investigations in the spaces between both the ribs and fins, and also have data on the local heat exchange on the surface of a finned tube in the bank. Results obtained from the investigations into variation in local velocity, flow turbulence, temperature and local heat transfer coefficients of a finned tube are presented. Author

N86-28384# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

MODELING OF VAPOR GENERATION IN FLASHING FLOW

J. Riznic and M. Ishii Dec. 1985 38 p

(Contract NRC-FIN-A-2026)

(TI86-006062; NUREG/CR-4501; ANL-86-1) Avail: NTIS HC A03/MF A01

A phenomenon of flashing related to discharging of an initially subcooled liquid from a high pressure condition into a low pressure environment is very important in several industrial systems such as nuclear reactors and chemical reactors. A model for the flashing process is proposed based on the wall nucleation theory, bubble growth model, and drift-flux bubble transport model. In order to calculate the bubble number density, the bubble number transport equation with a distributed source from the wall nucleation sites is used. The model predictions in terms of the void fraction are compared to the experimental data of Reocreux. It shows that satisfactory agreements could be obtained from the present model without any floating parameter to be adjusted with data. The result indicates that, at least for the experimental conditions considered here, the mechanistic prediction of the flashing phenomenon is

possible based on the present wall nucleation based model.
Author

N86-28237# San Diego State Univ., Calif. Dept. of Aerospace Engineering.
THE FLOWFIELD OF A SIDE-DUMP COMBUSTOR
Nagy Nosseir and Shabtay Behar *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 289-294 (For primary document see N86-28212 19-28)
(Contract N0014-84-K-0373)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28253*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
MODELING OF DENSE SPRAYS FROM LOX/H2 COAXIAL INJECTORS UNDER SUPERCRITICAL CONDITIONS
P. Y. Liang and R. J. Jensen *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 463-471 (For primary document see N86-28212 19-28)
(Contract NAS8-27980)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28255# Remtech, Inc., Huntsville, Ala.
BOUNDARY LAYER SIMULATOR (BLIMPJ) IMPROVEMENT
S. C. Praharaj *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 477-493 (For primary document see N86-28212 19-28)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-28385*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FEASIBILITY OF A NUCLEAR GAUGE FOR FUEL QUANTITY MEASUREMENT ABOARD AIRCRAFT
Jag J. Singh, Gerald H. Mall (Computer Sciences Corp., Hampton, Va.), Danny R. Sprinkle, and Hoshang Chegini (Old Dominion Univ., Norfolk, Va.) Aug. 1986 25 p
(NASA-TM-87706; L-16132; NAS 1.15:87706) Avail: NTIS HC A02/MF A01 CSCL 14B

Capacitance fuel gauges have served as the basis for fuel quantity indicating systems in aircraft for several decades. However, there have been persistent reports by the airlines that these gauges often give faulty indications due to microbial growth and other contaminants in the fuel tanks. This report describes the results of a feasibility study of using gamma ray attenuation as the basis for measuring fuel quantity in the tanks. Studies with a weak Am-241 59.5-keV radiation source indicate that it is possible to continuously monitor the fuel quantity in the tanks to an accuracy of better than 1 percent. These measurements also indicate that there are easily measurable differences in the physical properties and resultant attenuation characteristics of JP-4, JP-5, and Jet A fuels. The experimental results, along with a suggested source-detector geometrical configuration are described. Author

N86-28386*# California Inst. of Tech., Pasadena.
[THE HXII GAS SYSTEM] Final Report
1986 24 p
(Grant NAG5-175)
(NASA-CR-177882; NAS 1.26:177882) Avail: NTIS HC A02/MF A01 CSCL 14B

Two gas proportional counters were designed: one detector was patterned after the HEAO-1 design which possesses a proven low background capability at atmospheric pressure, and the other was a parallel planar geometry detector with an extensive drift region. The actual performance of the detectors was evaluated with emphasis on background rejection efficiency and position resolution. B.G.

N86-28387*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
CONCEPT STUDY OF A UV CORONAGRAPH SPECTROMETER FOR THE PINHOLE-OCCULTER FACILITY Final Report, 1 Oct. - 30 Nov. 1985
John L. Kohl Jul. 1986 28 p
(Grant NAG8-554)
(NASA-CR-177122; NAS 1.26:177122) Avail: NTIS HC A03/MF A01 CSCL 14B

The results of a very short study to define an Ultraviolet Coronagraph-Spectrometer (UVCS) for the Pinhole/Occulter Facility (P/OF) are summarized. The P/OF instrument was based on documentation from the Definition Phase of the Spacelab Coronographs Program which was effectively completed in August 1980. The primary differences between the P/OF instrument and the Spacelab experiment are the remote occulter mask, the telescope size , and the deployable structure to accommodate P/OF's length restrictions. Requirement for P/OF that are associated with these features are briefly considered, but further study is need to more fully consider the unusual implications, particularly in the interplay between the instrument pointing and the P/OF boom control. Author

N86-28388*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPROVED SKIN FRICTION INTERFEROMETER
R. V. Westphal, W. D. Bachalo, and M. H. Houser (Aerometrics, Inc., Mountain View, Calif.) Mar. 1986 48 p
(NASA-TM-88216; A-86138; NAS 1.15:88216) Avail: NTIS HC A03/MF A01 CSCL 14B

An improved system for measuring aerodynamic skin friction which uses a dual-laser-beam oil-film interferometer was developed. Improvements in the optical hardware provided equal signal characteristics for each beam and reduced the cost and complexity of the system by replacing polarization rotation by a mirrored prism for separation of the two signals. An automated, objective, data-reduction procedure was implemented to eliminate tedious manual manipulation of the interferometry data records. The present system was intended for use in two-dimensional, incompressible flows over a smooth, level surface without pressure gradient, but the improvements discussed are not limited to this application. Author

N86-28389*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IMPROVEMENT IN THE QUALITY OF FLOW VISUALIZATION IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL
Walter L. Snow, Alpheus W. Burner, and William K. Goad 1986 24 p
(NASA-TM-87730; L-16108; NAS 1.15:87730) Avail: NTIS HC A02/MF A01 CSCL 14B

Optical diagnostic techniques have not been as successful in the 0.3-Meter Transonic Cryogenic Tunnel as in conventional wind tunnels. This paper describes a simple shadowgraph experiment which allowed evacuation of the optical paths outside the test section. The results show that refractive index variations induced by temperature gradients outside the test section account for most of the image degradation. Earlier reports had erroneously attributed this degradation to inhomogeneities in the test section. Evacuation of the paths leading to and from the test section significantly improves the quality of flow visualization.
Author

N86-28390# Department of the Navy, Washington, D. C.
COMPLEX CAVITY GYROTRON Patent
Michael E. Read, Yuval Carmel, Kwo R. Chu, and Achintya K.

Ganguly, inventors (to Navy) Issued 19 Nov. 1985 7 p Supersedes AD-D010591
(AD-D012139; US-Patent-4,554,484; US-Patent-Appl-SN-527626; US-Patent-Class-315-4) Avail: US Patent and Trademark Office CSCL 09/1

A complex gravity gyrotron designed for stable operation at high order modes is described. The device comprises circuitry for generating an annular electron beam, a coupled cavity disposed coaxially with the electron beam and having a first and second adjacent coaxial sections with the dimensions of these coaxial sections adjusted so that different modes with the same azimuthal eigen number but different radial eigen numbers are simultaneously resonant at approximately the same frequency in the two sections, and circuit for generating an axial magnetic field within the cavity. Few, if any, combinations of modes other than the combination chosen will simultaneously resonate in the cavity thereby effecting higher order mode suppression. The present design has a low susceptibility to beam velocity spread and its effective for any combination of modes with identical azimuthal eigen numbers. GRA

N86-28391# Department of the Navy, Washington, D. C.
QUASI-OPTICAL HARMONIC GYROTRON AND GYROKLYSTRON Patent
Wallace Manheimer, inventor (to Navy) and Baruch Levush, inventor (to Navy) Issued 17 Dec. 1985 10 p Supersedes AD-D011308 (AD-D012199; US-Patent-4,559,475; US-Patent-Appl-SN-630049; US-Patent-Class-315-4) Avail: US Patent and Trademark Office CSCL 09/1

This patent discloses a method and apparatus for suppressing lower order cyclotron harmonics in order to permit resonance within a quasi-optical gyrotron/gyroklystron configuration of a desired high order harmonic. In the gyrotron/gyroklystron configuration at least one open resonator defined by at least two mirrors is positioned downstream from an electron beam source for receiving therethrough the beam of electrons and for exchanging energy therewith. This method includes the steps for choosing a mirror radius size large enough relative to the spot size of a desired radiation cyclotron harmonic so that the harmonic oscillates within the at least one resonator, but small enough so that the spot size for the next lower cyclotron harmonic is larger than the mirror so that harmonic does not oscillate due to diffraction losses. This method further includes the step of generating an electron beam bias the electron beam source with a beam current which is greater than or equal to the starting current for the desired nth cyclotron harmonic, but less than the starting current for the nth cyclotron harmonic. GRA

N86-28392# Los Alamos National Lab., N. Mex.
MULTICHANNEL ANALOG TEMPERATURE SENSING SYSTEM
R. Gribble Aug. 1985 5 p
(Contract W-7405-eng-36)
(DE86-004371; LA-10475-MS) Avail: NTIS HC A02/MF A01

A multichannel system that protects the numerous and costly water-cooled magnet coils on the translation section of the FRX-C/T magnetic fusion experiment is described. The system comprises a thermistor for each coil, a constant current circuit for each thermistor, and a multichannel analog-to-digital converter interfaced to the computer. DOE

N86-28393# Lawrence Livermore National Lab., Calif.
EXPERIENCES IN CONTROL SYSTEM DESIGN AIDED BY INTERACTIVE COMPUTER PROGRAMS: TEMPERATURE CONTROL OF THE LASER ISOTOPE SEPARATION VESSEL
D. T. Gavel, L. C. Pittenger, J. S. McDonald, P. G. Cramer, and C. J. Herget 1985 10 p Presented at the 24. IEEE Conference on Decision and Control, Ft. Lauderdale, FL., 11 Dec. 1985
(Contract W-7405-eng-48)
(DE86-004481; UCRL-93713; CONF-851209-7) Avail: NTIS HC A02/MF A01

A robust control system has been designed to regulate temperature in a vacuum vessel. The thermodynamic process is modeled by a set of nonlinear, implicit differential equations. The control design and analysis task exercised many of the computer-aided control systems design software packages, including MATLAB, DELIGHT, AND LSAP. The working environment is a VAX computer. Advantages and limitations of the software and environment, and the impact on final controller design is discussed. DOE

N86-28394# Technische Hochschule, Aachen (West Germany). Inst. fuer Theroretische Elektrotechnik.
DIRECT WRITING ELECTRON BEAM LITHOGRAPHY Final Report, Jun. 1984
Walter L. Engl, Dirk Beets, and Hans-Rainer Schulte Bonn Bundesministerium fuer Forschung und Technologie Nov. 1985 215 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-132; ISSN-0340-7608; ESA-86-96893) Avail: NTIS HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38

A quasi-shaped-beam method to enhance the throughput of a vector scan electron-beam lithography system using a circular spot with Gaussian shaped current density distribution was developed. Spot diameter is switched by varying the condenser currents. Exposure spot movements caused by mean size switching are prevented using an adapted control of the electron source alignment coils. An ultrahigh vacuum sealed anode chamber was built to use LaB6 cathodes. A part of its emitted light is reflected to a specially developed quotient pyrometer to measure the cathode tip temperature. A modified correlation method enables use of process induced topographical markers for wafer alignment. Necessary short detection time is achieved by pipelining and parallel processing techniques using microprocesser controlled signal processing hardware. The underetching of the marker generating process is measured with the position detection. ESA

N86-28395# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
ASSESSMENT OF THE PIEZO-ELECTRIC FOIL AS A MEANS OF MONITORING WALL TURBULENCE
Joergen Olsson, A. K. Lewkowicz, and S. C. Cheah 6 Nov. 1985 32 p
(FFA-TN-1985-60; ESA-86-97053) Avail: NTIS HC A03/MF A01

The feasibility of a commercial piezo-film as a transducer for monitoring turbulent properties of wall shear flows was assessed. A fully developed turbulent pipe flow with variable Reynolds number along with a separated and reattaching flow were used. Probe design, manufacture, and signal processing are outlined. It is concluded that the concept is promising for practical applications and could compete successfully with other turbulence sensors. ESA

N86-28396# Institute of Oceanographic Sciences, Birkenhead (England).
PERFORMANCE OF THE LOW PRESSURE DIFFERENTIAL AND ABSOLUTE DIGIQUARTZ PRESSURE TRANSDUCERS
A. D. Banaszek 1985 34 p
(IOS-215; ESA-86-97122) Avail: NTIS HC A03/MF A01

Long term performance of pressure transducers used for sea level measurements was assessed. The differential and low pressure absolute digiquartz instruments exhibit extremely good long term stability but suffer from short term instability which leads to initial drift and is caused by the mechanics of the bellows. Differences in calibrations over several years can mostly be accounted for in terms of common mode line pressure effects, whereas changes in the zero pressure output are a result of the mechanical instability of the bellows. The exponential drift that can occur is shown to be reversible and has a time constant of 40 hr. Thus, datum shifts occur when the transducer is deployed, the magnitude of which depends on the particular transducer and the differential pressure. ESA

N86-28397 United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
THE EFFECTS OF TEMPERATURE AND IRRADIATION ON

PIEZOELECTRIC ACOUSTIC TRANSDUCERS AND MATERIALS
G. H. Broomfield Dec. 1985 37 p
(AERE-R-11942) Copyright. Avail: Issuing Activity

The testing, selection and application of materials for piezoelectric acoustic transducers are discussed. The construction of high frequency transducers and the effects of irradiation and temperature on types designed for arduous service are described. The criteria for assessing piezoelectric materials are given as a preamble to a brief discussion of the effects on them of temperature and irradiation. These materials include the powder-route ceramics, lead metaniobate and lead-zirconate-titanate and the single crystal materials, quartz, tourmaline, lithium niobate and strontium niobate. Conclusions on the materials are concerned with the probable future temperature ranges for their applications. Author

N86-28398 British Gas Corp., London (England).
THE APPLICATION OF VIBRATING WIRE STRAIN GAUGE IN EXERCISE OF INSTALLATION AT POTENTIALLY UNSTABLE SITES
C. Gramola and S. Venzi Jan. 1985 15 p Transl. into ENGLISH of conference paper presented at the National Convention of the Italian Association for the Analysis of Stress, 1872 Convention held in Calabria, Italy, 22-25 Sep. 1982
(TI86-910153; BLL-BG-Trans-700A-(9022.048); T700A/BG/ERS/BS-71/05792) Copyright. Avail: Issuing Activity

The analysis in the time of stresses, induced in pipes placed in areas liable to landslides, was solved by the adoption of a suitable appliance of vibrating wire strain gauges. This was possible when the stress condition in a cross section was transferred to monoaxial deformation measurement only by an instrument of high sensitivity as the vibrating wire strain gauge. Author

N86-28695# Joint Publications Research Service, Arlington, Va.
A NEW WAY OF HOLOGRAPHIC RECORDING OF INFORMATION
A. A. Vasilyev, P. V. Vashurin, V. A. Yelkhov, I. N. Kompanyets, A. V. Prafenov, and P. M. Semochkin *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-004) 25 Apr. 1986 p 10 Transl. into ENGLISH from Priroda (Moscow, USSR), no. 12, Dec. 1985 p 104 (For primary document see N86-28694 19-70)
Avail: NTIS HC A04/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-28399*# Hampton Inst., Va. Dept. of Physics and Engineering.
DIRECT SOLAR-PUMPED IODINE LASER AMPLIFIER Semiannual Progress Report, 1 Oct. 1985-30 Mar. 1986
Kwang S. Han Mar. 1986 61 p
(Grant NAG1-441)
(NASA-CR-177238; NAS 1.26:177238) Avail: NTIS HC A04/MF A01 CSCL 20E

During this period the parametric studies of the iodine laser oscillator pumped by a Vortek simulator were carried out before amplifier studies. The amplifier studies are postponed to the extended period after completing the parametric studies. In addition, the kinetic modeling of a solar-pumped iodine laser amplifier, and the experimental work for a solar pumped dye laser amplifier are in progress. This report contains three parts: (1) a 10 W CW iodine laser pumped by a Vortek solar simulator; (2) kinetic modeling to predict the time to lasing threshold, lasing time, and energy output of solar-pumped iodine laser; and (3) the study of the dye laser amplifier pumped by a Tamarack solar simulator. Author

N86-28400# Connecticut Univ., Storrs. Dept. of Physics.
RADIATIONLESS DEACTIVATION OF LOW-FIELD CHROMIUM COMPLEXES IN SOLIDS Final Technical Report, 31 Aug. 1982 - 31 Dec. 198
Ralph H. Bartram 20 Feb. 1986 27 p
(Contract DAAG29-82-K-0158)
(AD-A165734; ARO-18764.7-PH) Avail: NTIS HC A03/MF A01 CSCL 20/5

Thermal quenching of fluorescence is a major loss mechanism which may impede the performance of tunable solid-state lasers, but whose impact is difficult to assess a-priori. The object of the reported investigation was to achieve a quantitative understanding of the factors which control this process, with the ultimate goal of formulating design criteria for tunable solid-state laser materials. The temperature dependence of chromium photoluminescence spectra and lifetimes has been measured in ordered-perovskite (Cs2NaYC16, K2NaScF6 and K2NaGaF6) low-crystal-field host crystals. After the failure of linear-coupling models was demonstrated, a successful theoretical model was proposed in which fluorescence quenching is mediated by quadratic coupling to assymetric modes of vibration. Parameters of the model are constrained by empirical spectral information, and radiationless transition rates are calculated by numerical line-shape simulation. Both semi-empirical (INDO) and ab-initio molecular-orbital cluster calculations have been performed in conjunction with lattice-statics calculations in a continuing effort to refine this quenching model. Photoluminescence spectra and lifetimes, measured as functions of temperature and pressure in a diamond-anvil cell, revealed a pressure-induced transition from broad-band fluorescence to narrow-band phosphorescence; i.e., from low-crystal-field to high-crystal-field behavior. GRA

N86-28401# Williams Coll., Williamstown, Mass. Dept. of Physics and Astronomy.
ATOMIC HYDROGEN MASER INVESTIGATIONS OF HYDROGEN ATOM INTERACTIONS FROM 4 K TO 12 K Final Report, 1 Mar. 1980 - 28 Feb. 1985
Stuart B. Crampton 24 Mar. 1986 18 p
(Contract N00014-80-C-0240; RR0-1103)
(AD-A165807) Avail: NTIS HC A02/MF A01 CSCL 20/5

Techniques developed during previous studies of the ground state hyperfine resonance of hydrogen atoms intermittently adsorbed on molecular hydrogen surfaces were used to develop a cryogenic atomic hydrogen maser using a 5 K state-selected H atom beam and solid neon storage surfaces near 10 K temperature. The physical parameters affecting the use of such a device for frequency metrology and precision measurements of atomic parameters were determined. GRA

N86-28402# Los Alamos National Lab., N. Mex.
INVESTIGATION OF METAL COATINGS FOR THE FREE ELECTRON LASER
Marion L. Scott, Paul N. Arendt, Robert W. Springer, Richard C. Cordi, and William J. McCreary 1985 12 p Presented at the 17th Annual Symposium on Optical Materials for High Power Lasers, Boulder, Colo., 28-30 Oct. 1985
(Contract W-7405-eng-36)
(DE86-006008; LA-UR-86-100; CONF-851052-3) Avail: NTIS HC A02/MF A01

The deposition and characteristics of metal coatings for use in environments such as the Free Electron Laser where the radiation resistance of metal coatings could prove to be of great benefit were studied. Initial efforts concentrated on silver laminate coatings due to the high reflectance of silver at 1 micron wavelength. The initial laminate coatings utilized thin layers of titanium oxide to break up the columnar structure of the silver during electron-beam deposition on fused silica substrates. Initial results on equal coating thickness samples indicate an improvement in damage threshold that ranges from 1.07 to 1.71 at 351 nm. Author

N86-28403# Los Alamos National Lab., N. Mex.
AURORA PROJECT: OPTICAL DESIGN FOR A KILOJOULE CLASS KrF LASER
J. Hanlon, J. McLeod, J. E. Sollid, W. Horn, III, R. Carmichael, B. Kortegaard, G. Woodfin, and L. Rosocha 1985 7 p Presented at the Southwest Conference on Optics, Albuquerque, N. Mex., 4

Apr. 1985
(Contract W-7405-eng-36)
(DE85-014078; LA-UR-85-2245; CONF-850345-26) Avail: NTIS Avail: NTIS HC A02/MF A01

Aurora is a 248-nm, 10-kilojoule laser system being built at Los Alamos National Laboratory to demonstrate the feasibility of large KrF laser systems for laser fusion. It was designed as a test bed to demonstrate: (1) efficient energy extraction at 248 nm; (2) an angularly multiplexed optical system that is scaleable to large system designs; (3) the control of parasitics and ASE (amplified spontaneous emission); (4) long path pulse propagation at UV wavelengths; (5) alignment systems for multibeam systems; and (6) new or novel approaches to optical hardware that can lead to cost reduction on large systems. In this paper only issues pertinent to the optical system are addressed. First, a description of the entire system is given. The design constraints on the optical system are explained, concurrent with a discussion of the final design. This is followed by a very brief discussion of coatings; in particular, the use of sol-gels for antireflection coatings is presented. DOE

N86-28404# Lawrence Livermore National Lab., Calif.
PERFORMANCE DEGRADATION IN LASER WEAPON SYSTEMS DUE TO PERTURBATION OF OPTICAL MIRRORS
J. SooHoo 16 Dec. 1985 45 p
(Contract W-7405-eng-48)
(DE86-005761; UCID-20640) Avail: NTIS HC A03/MF A01

In terms of maximizing the laser intensity at the target, we calculate and evaluate the performance of a generic laser weapon system in the presence of induced perturbations. Such perturbations include mirror tilts and mirror displacements, which may result from structure vibration and coolant flow. We also consider the effect on the beam quality due to blockage by the secondary mirror and nonuniformity in the laser amplitude. Additionally, we show the relationship between the far-field characteristics and the near-field ray angle and phase functions across the aperture plane, which is useful for beam control purposes. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-28405 National Physical Lab., Teddington (England). Div. of Materials Applications.
THE TECHNICAL BACKGROUND TO THE REVISION OF BS 4429: 1969 SPECIFICATION FOR RIGGING SCREWS AND TURNBUCKLES
T. A. E. Gorley Dec. 1985 39 p
(NPL-DMA(A)108; ISSN-0143-7313; ESA-86-97128) Copyright. Avail: Issuing Activity

The design criteria and the methods of design for component specified in standard BS 4429 are described: rigging screw bodies; turnbuckles and pipe hangers; and accessories (screw threads, screwed elongated eyes, screwed forks, screwed trapezoidal hooks, and locknuts). ESA

N86-28406 National Physical Lab., Teddington (England). Div. of Materials Applications.
BACKGROUND DISCUSSION PAPER FOR THE DEVELOPMENT OF R AND D STRATEGY IN THE AREA OF JOINING TECHNOLOGY
L. N. McCartney Nov. 1985 27 p
(NPL-DMA(A)110; ISSN-0143-7313; ESA-86-97129) Copyright. Avail: Issuing Activity

The uses of composite materials, ceramics, plastics and adhesives in manufacturing industry are reviewed and the importance of joining technology to their application is emphasized. Adhesive bonding; welding thermoplastics; and joining ceramics to metals are discussed. ESA

N86-28407*# National Aeronautics and Space Administration, Washington, D.C.
APPLICATIONS OF TETHERS IN SPACE: WORKSHOP PROCEEDINGS, VOLUME 1
William A. Baracat, comp. (General Research Corp., McLean, Va.) Jun. 1986 585 p Workshop held in Venice, Italy, 15-17 Oct. 1985; sponsored by NASA, the Italian National Space Plan and CNR
(Contract NASw-3921)
(NASA-CP-2422-Vol-1; NAS 1.55:2422-Vol-1) Avail: NTIS HC A25/MF A01 CSCL 13I

The complete documentation of the workshop including all addresses, panel reports, charts, and summaries are presented. This volume presents all the reports on the fundamentals of applications of tethers in space. These applications include electrodynamic interactions, transportation, gravity utilization, constellations, technology and test, and science applications. For individual titles, see N86-28408 through N86-28431.

N86-28408*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TETHERED SATELLITE SYSTEM c18
James Sisson *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 37-61 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

A reusable system is to be developed to enable a variety of scientific investigations to be accomplished from the shuttle, considering the use of a tethered system with manual or automated control, deployment of a satellite toward or away from the Earth, up to 100 km, and conducting or nonconducting tether. Experiments and scientific investigations are to be performed using the tether system for applications such as magnetometry, electrodynamics, atmospheric science, and chemical release. A program is being implemented as a cooperative U.S./Italian activity. The proposed systems, investigations, and the program are charted and briefly discussed. E.R.

N86-28409*# Consiglio Nazionale delle Ricerche, Rome (Italy). Programma Spaziale Nazionale.
TETHERED SATELLITE DESIGN c18
Gianfranco Manarini *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 63-79 Vol-1) (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The capability of the satellite to perform a variety of space operations to be accomplished from the shuttle is reviewed considering use of the satellite with man-in-loop and closed loop modes and deployment (toward or away from Earth, up to 100 km), stationkeeping, retrieval and control of the satellite. Scientific payloads are to be used to perform experiments and scientific investigation for applications such as magnetometry, electrodynamics, atmospheric science, chemical release, communications, plasmaphysics, dynamic environment, and power and thrust generation. The TSS-S will be reused for at least 3 missions after reconfiguration and refurbishment by changing the peculiar mission items such as thermal control, fixed boom for experiments, aerodynamic tail for yaw attitude control, external skin, experiments, and any other feature. The TSS-S is to be composed of three modules in order to allow independent integration of a single module and to facilitate the refurbishment and reconfiguration between flights. The three modules are service, auxiliary propulsion, and payload modules. E.R.

N86-28410*# Energy Science Labs., Inc., San Diego, Calif.
TETHER FUNDAMENTALS
Joseph A. Carroll *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 81-101 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Some fundamental aspects of tethers are presented and briefly discussed. The effects of gravity gradients, dumbbell libration in

circular orbits, tether control strategies and impact hazards for tethers are among those fundamentals. Also considered are aerodynamic drag, constraints in momentum transfer applications and constraints with permanently deployed tethers. The theoretical feasibility of these concepts are reviewed. E.R.

N86-28411*# Padua Univ. (Italy). Inst. of Applied Mechanics.
A REVIEW OF TETHER INDUCED DYNAMICAL FEATURES
Silvio Bergamaschi *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 103-116 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The simplest mathematical model used for the simulation of TSS motion is considered in order to review the dynamics of tethers. This model is discussed. Also reviewed are elasticity effects, perturbation sources, orbit eccentricity and natural frequencies. Tethered systems provide a unique opportunity for skilled measurement activities in space. Some of the experiments envisaged require the measurement of very small mechanical quantities. This implies that the level of dynamical noise on instruments output be low or that system response to excitation, either external or internal, be sufficiently known. In this respect, the first TSS flights will be very useful, but much work will be needed in order to have reliable estimates of structural damping in different future systems. E.R.

N86-28412*# Rome Univ. (Italy). Dipt. Fisica.
SCIENCE APPLICATIONS c12
Franco Mariani *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 117-126 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Possible scientific applications in the field of the neutral ionized atmosphere and of the solid Earth in terms of the TSS are summarized. Studies of the vertical, zonal, and meridional neutral winds and temperature, whose extensive variations suggest the importance of energy transfer mechanism in modifying the structural properties of the region are reviewed. Layers below the F region of high plasma density that propagate to lower altitudes with drift velocities will be studied for their electron and ion composition and motion. These are to be measured by the TSS in conjunction with ground based radar observations. Basic fluid dynamics problems will be studied onboard tethered satellites. Studies will be conducted on the structure of the equatorial electrojet, in particular its longitudinal and meridional extent. Magnetic measurements will also be used to probe the tether current distribution in the plasma sheath. E.R.

N86-28413*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATIONS OF TETHERS FOR PLANETARY MISSIONS c12
Paul Penzo *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 127-151 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Ideas of deep space exploration are considered. The role of tethers in deep space is of most concern. A proposal of a tethered instrument package in orbit about the Moon is explored. The idea of a sling on the surface of the Moon which would take solar energy and build up momentum of the sling is studied. The NASA idea of a Mars Aeronomy Orbiter which would use a tether to enhance the planned Mars Orbiter is reviewed. It is also proposed that a tether can be attached to an asteroid during a spacecraft flyby. The possibility of using tethers to provide a transportation system for payloads which are coming to the surface from escape, and which are leaving Mars and escaping from Mars itself is also studied. A proposal from the Jet Propulsion Lab. on collecting comet or asteroid samples and returning them to Earth is reviewed. A tethered penetrator which could collect core samples is the proposed way. Also considered is the area of electrodynamic tethers at Jupiter. E.R.

N86-28414*# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. Fisica Spazio Interplanetario.
ELECTRODYNAMIC INTERACTIONS
Marino Dobrowolny *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 153-160 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The electrodynamic interaction of long metallic tethers with the ionosphere is introduced. Due to the tether's motion across the Earth's field, a polarization electric field is generated along the tether. In a system like the Tethered Satellite System (TSS) where the tether is coated with dielectric and the electrical contact is between its two terminations and the ionosphere, the upper end termination will collect electrons and, in a passive system, the lower end termination will collect ions. Space charge regions will develop around the two terminations of the system, which can be at considerable potential with respect to the unperturbed ionospheric plasma and the current in the tether will be most significantly determined by local processes in such space charge regions. A qualitative view of the global perturbation induced by TSS in the ionosphere is outlined. One of the applications of electrodynamic tethers is that of using them as low frequency wave generators to communicate to the Earth. This application is briefly discussed. An equivalent circuit of the tether system is described. The basic equation of the circuit is given. E.R.

N86-28415*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTRODYNAMIC INTERACTIONS c12
James McCoy *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 161-184 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Power and thrust applications of the electrodynamic tether are considered. The induced voltage in the tether wire is in the same direction in the case of a power generator and a spacecraft motor, and the difference involves whether one allows that voltage to drive a current to generate power. Or, if one uses an onboard power supply with a higher voltage to drive a current in the opposite direction, which then provides thrust. Return circuit currents must be spread out through the ionosphere sufficiently so that ionosphere conductivities are very high and so that anomalous resistance is not produced in the ionosphere which would prevent the current from flowing. This is largely a function of the plasma contactors that are used. Three have been most frequently considered. It is concluded that, for the primary power and thrust applications, the hollow cathode seems to be far superior to the electron gun for producing high current contact to the ionosphere. This has led to a study of the Plasma Motor Generator (PMG) because it is capable of being reversed. The PMG theory is explored along with other power and thrust applications of the electrodynamic tether. E.R.

N86-28416*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRANSPORTATION
Georg vonTiesenhausen *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 185-219 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

A summary of tether transportation is given. Four steps were used over a period of time. First, theoretical engineering feasibility and technology requirements were determined. Then the survivors of that effort went into step two in the analysis of promising candidates. Those survivors went into the third phase which is engineering design and cost benefits. Survivors entered into the demonstration mission definition phase. Transportation studies have covered two kinds of deployments. First, steady state deployment was studied. Like the TSS, it's nearly vertical. It takes a long time to deploy and involves relatively high tether tension. Secondly, dynamic deployment was studied. Deployment started in an almost horizontal direction under a very shallow angle which allows a high deployment rate under very low tension. Momentum transfer here occurs by libration. Specific payloads were used to

study tethered transportation benefits. Four transportation concepts were studied with regard to cost benefits. A tethered orbiter deboost from the space station, an OTV boost up from the Space Station, a science platform on a tether with a possible micro-g lab moving in between platform and station, and a tethered boost of payloads fromthe orbiter are the four concepts. These benefits are examined in detail. E.R.

N86-28417*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
US GRAVITY UTILIZATION OF TETHERS ACTIVITY
Kenneth Kroll *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 223-238 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The feasibility, requirements, and limitations of fluid transfer on a tethered system is evaluated. The study is conducted to simplify fluid transfer and to improve safety. The effects of gravity on these factors is also noted. Tether orbital refueling is used to settle fluid and to overcome the surface tension forces that are in space with the gravity level. It also allows a separation, when on the space station, from contamination and also from explosion hazards. Once the cryogenic propellant is settled the most important thing is the fluid slosh. Future plans of a gravity laboratory and a demonstration of gravity utilization using a TSS type of deployer are considered. E.R.

N86-28418*# Martin Marietta Aerospace, Denver, Colo.
TETHER APPLICATIONS FOR SPACE STATION c12
William Nobles *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 239-267 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

A wide variety of space station applications for tethers were reviewed. Many will affect the operation of the station itself while others are in the category of research or scientific platforms. One of the most expensive aspects of operating the space station will be the continuing shuttle traffic to transport logistic supplies and payloads to the space station. If a means can be found to use tethers to improve the efficiency of that transportation operation, it will increase the operating efficiency of the system and reduce the overall cost of the space station. The concept studied consists of using a tether to lower the shuttle from the space station. This results in a transfer of angular momentum and energy from the orbiter to the space station. The consequences of this transfer is studied and how beneficial use can be made of it. E.R.

N86-28419*# Aeritalia S.p.A., Torino (Italy). Space Systems Group.
THE SCIENCE AND APPLICATIONS TETHERED PLATFORM (SATP) PROJECT c12
Pietro Merlina *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 269-278 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The capabilities of tether systems in orbit are going to be demonstrated by the first planned flights of the Tethered Satellite System (TSS). These test flights will investigate the properties of tether systems as low altitude atmospheric research facilities and as electric power generators. Studies are being conducted with the purpose of testing a variety of concepts and approaches. A comparative analysis of results will allow the choosing of the most promising ideas for further development. The broad range of applications presently under study include applications in electrodynamics, transportation, microgravity in addition to basic research. The SATP project definition study is now about midway through its first phase. The analyses conducted have led to an appraisal of users interest in the project and to a deeper understanding of the problems associated with large, long-lived tether systems in space. In addition, two specialized platform designs, devoted to microgravity and precise pointing applications, are being studied because of their potential usefulness and the promise of technical feasibility. E.R.

N86-28420*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TECHNOLOGY AND TEST c12
Paul Siemers *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 279-283 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The chairman of the Technology Applications in Space Working Group summarizes the technology issues for each of the disciplines in Tethered Satellite Systems. The disciplines are Tether Materials and Configurations, Tether System Dynamic Simulation Capability, Tether System Instrumentation, TAS Program Related Science Instrumentation, Atmospheric/Aerothermodynamic tethered system research, and TAS Discipline Program Accomplishment. To enable these tether applications, design and development programs have been recommended and are presently underway relative to the demonstration of the hollow cathode concept which is an enabling electrodynamic tether mission technology. E.R.

N86-28421*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
TETHERED CONSTELLATIONS c12
Enrico Lorenzini *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 285-308 Pergammon Press Ltd. (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The studies that have been carried out on Tethered Constellations are briefly addressed. A definition of a tethered constellation is any number of masses/platforms greater that two connected by tethers in a stable configuration. Configurations and stability constraints are reviewed. Conclusions reached are: (1) The 1-D, horizontal, passively stabilized constellations have been ruled out; (2) Fishbone constellations have been also ruled out; (3) Alternative stable 2-D configurations have been devised such as the quadrangular configuration stabilized by electrodynamic forces (ESC), the quadrangular configuration stabilized by differential air drag (DSC), and the pseudo elliptical configuration stabilized by electrodynamic forces (PEC). Typical dimensions for these constellations are 10 km (horizontal) by 20 km (vertical) with balloon diameters around 100 m in the case of a DSC and a power consumption around 7 KW for an ESC or PEC. E.R.

N86-28422*# Science Research Council, Chilton (England). Rutherford Appleton Lab.
LOWER THERMOSPHERE DENSITIES OF N2, O AND Ar UNDER HIGH LATITUDE WINTER CONDITIONS c46
Paul H. G. Dickinson, U. vonZahn (Bonn Univ., West Germany), K. D. Baker (Utah State Univ., Logan), and D. B. Jenkins (University Coll. of Wales, Aberystwyth) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 321-328 Pergamon Press Ltd. Repr. from Journal of Atmospheric and Terrestrial Physics (England), v. 47, no. 1-3, 1985 p 283-290 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Measurements of the neutral thermosphere were conducted in northern Scandinavia during the Energy Budget Campaign. These measurements included determinations of N2, O, and Ar densities using rocket-borne experiments. The results obtained in the experiments are presented, taking into account also details regarding the employed experimental methods, and an evaluation of the significance of the data. It is found that there are striking differences in thermospheric distributions of the neutral constituents under different geomagnetic conditions. Under quiet geomagnetic conditions there was reasonable agreement with the United States Standard Atmosphere. The concentrations of N2 and Ar were about 70 percent of the predicted values, while the O concentration was about 2.5 times greater. E.R.

N86-28423*# Los Alamos National Lab., N. Mex.
BISTATIC LIDAR EXPERIMENT PROPOSED FOR THE SHUTTLE/TETHERED SATELLITE SYSTEM MISSIONS c12
David J. McComas, Harlan E. Spense (California Univ., Los

Angeles), Robert R. Karl, Henry G. Horak, and Thomas D. Wilkerson (Maryland Univ., College Park) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 329-347 American Inst. of Physics Repr. from Review of Scientific Instruments, v. 56, no. 5, May 1985 p 670-673 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

A new experiment concept has been proposed for the shuttle/tethered satellite system missions, which can provide high resolution, global density mappings of certain ionospheric species. The technique utilizes bistatic LIDAR to take advantage of the unique dual platform configuration offered by these missions. A tuned, shuttle-based laser is used to excite a column of the atmosphere adjacent to the tethered satellite, while triangulating photometic detectors on the satellite are employed to measure the fluorescence from sections of the column. The fluorescent intensity at the detectors is increased about six decades over both ground-based and monostatic shuttle-based LIDAR sounding of the same region. In addition, the orbital motion of the Shuttle provides for quasi-global mapping unattainable with ground-based observations. Since this technique provides such vastly improved resolution on a synoptic scale, many important middle atmospheric studies, heretofore untenable, may soon be addressed. Author

N86-28424*# Naples Univ. (Italy). Inst. of Gasdynamics.
HIGH RESOLUTION REMOTE SENSING MISSIONS OF A TETHERED SATELLITE c43
Sergio Vetrella and A. Moccia *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 349-363 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The application of the Tethered Satellite (TS) as an operational remote sensing platform is studied. It represents a new platform capable of covering the altitudes between airplanes and free flying satellites, offering an adequate lifetime, high geometric and radiometric resolution and improved cartographic accuracy. Two operational remote sensing missions are proposed: one using two linear array systems for along track stereoscopic observation and one using a synthetic aperture radar combined with an interferometric technique. These missions are able to improve significantly the accuracy of future real time cartographic systems from space, also allowing, in the case of active microwave systems, the Earth's observation both in adverse weather and at any time, day or night. Furthermore, a simulation program is described in which, in order to examine carefully the potentiality of the TS as a new remote sensing platform, the orbital and attitude dynamics description of the TSS is integrated with the sensor viewing geometry, the Earth's ellipsoid, the atmospheric effects, the Sun illumination and the digital elevation model. A preliminary experiment has been proposed which consist of a metric camera to be deployed downwards during the second Shuttle demonstration flight. Author

N86-28425*# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
LABORATORY SIMULATION OF THE ELECTRODYNAMIC INTERACTIONS OF A TETHERED SATELLITE WITH AN IONOSPHERIC PLASMA
Carlo Bonifazi, Jean Pierre Lebreton (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), G. Vannaroni, Cristiano Cosmovici, R. Debrie (Centre National de la Recherche Scientifique, Orleans, France), M. Hamelin, L. Pomathiod, and H. Arends (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 401-420 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

An improved experimental set-up in the Orleans Plasma Chamber allowed investigations of the I-V characteristics of a conductive spherical body (10 cm diameter) in a plasma environment. Moreover, the influence of a transversal magnetic field at 0.6 and 1.2 G was investigated, for the first time, both on the sheath potential profile and current collection. Floating potential profiles were measured at 16 different radial distances from the test body up to 9 body radii in 8 different angular positions. The test body potential could be increased in the range from -200 V up to +100 V. Preliminary results are shown and discussed. Author

N86-28426*# Genoa Univ. (Italy).
NATURAL ELF NOISE EVALUATION FOR TSS EMISSIONS DETECTION ON THE EARTH'S SURFACE. THE ELECTRIC FIELD COMPONENT APPROACH c32
Giorgio Tacconi *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 421-430 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The preliminary estimate of the local noise structure in the proximity of a receiver is essential to establishing the detectability of a given signal in presence of such noise. The possibility of detecting the Electric Field Component of the background noise by means of electric dipoles horizontally placed on the sea bed in shallow water is outlined, in order to find its spectral and statistical characteristics for the definition of the optimal receiving system. Author

N86-28427*# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. Fisica Spazio Interplanetario.
SPONTANEOUS RADIATION EMITTED BY MOVING TETHERED SYSTEMS c32
Marino Dobrowolny *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 431-439 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Some concepts related to radiation emitted by a large conductor moving through a magnetoplasma are outlined and referred to the case of long tethers. Some recent results of a theoretical calculation of Alfven wings, their structure and the power associated with are shown. How the problem of radiation from TSS or for any large conductor moving through a magnetoplasma should be approached is presented. The approach is that of the theory of antennas in plasmas. E.R.

N86-28428*# Consiglio Nazionale delle Ricerche, Frascati (Italy). Piano Spaziale Nazionale.
TETHERED SATELLITE SYSTEM (TSS) CORE EQUIPMENT
Carlo Bonifazi *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 441-469 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

To date, three Tethered Satellite System (TSS) missions of the Italian provided scientific satellite orbiting in the ionosphere connected to U.S. Space Shuttle is foreseen. The first mission will use an electrically conductive tether of 20 km deployed upward from the orbiter flying at 300 km altitude. This mission will allow investigation of the TSS electrodynamic interaction with the ionosphere due to the high voltage induced across the two terminators of the system during its motion throughout the geomagnetic field. The second mission will use a dielectric tether of 100 km deployed downward from the Orbiter flying at 230 km altitude. Tethered-vehicle access to altitude as low as 120 to 150 km from the Orbiter would permit direct long term observation of phenomena in the lower thermosphere and determination of other dynamical physical processes. The third mission would use the same configuration of the first electrodynamic mission with the complete Core Equipment. Study of power generation by tethered systems would be possible by operating the Core Equipment in the inverted current mode. This mode of operation would allow ion current collection upon the TSS satellite by controlling its potential with respect to the ambient ionospheric plasma. The main requirements of the Core Equipment configuration to date foreseen for the first TSS electrodynamic mission is described. Besides the Core Equipment purposes, its hardware and operational sub-modes of operation are described. E.R.

N86-28429*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PLASMA CONTACTOR PERFORMANCE CHARACTERIZATION c32
Paul Wilbur *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 483-498 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The plasma contactor performance is outlined. Some performance objectives are given including expellant compatibility, high electron production capability, high ion production capability, high reliability for starting and operation, passive emission control, switchover capability between ion/electron emission, low ion and electron energies, low system mass, and low expellant consumption rate. The basic elements of the hollow cathode are shown along with key features of the plasma source. E.R.

N86-28430*# Systems Science and Software, La Jolla, Calif.
THEORY OF PLASMA CONTRACTORS FOR ELECTRODYNAMIC TETHERED SATELLITE SYSTEMS c33
Donald E. Parks and I. Katz *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings Volume 1 Jun. 1986 p 499-546 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

Recent data from ground and space experiments indicate that plasma releases from an object dramatically reduce the sheath impedance between the object and the ambient plasma surrounding it. Available data is in qualitative accord with the theory developed to quantify the flow of current in the sheath. Electron transport in the theory is based on a fluid model of a collisionless plasma with an effective collision frequency comparable to frequencies of plasma oscillations. The theory leads to low effective impedances varying inversely with the square root of the injected plasma density. To support such a low impedance mode of operation using an argon plasma source for example requires that only one argon ion be injected for each thirty electrons extracted from the ambient plasma. The required plasma flow rates are quite low; to extract one ampere of electron current requires a mass flow rate of about one gram of argon per day. Author

N86-28431*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTRODYNAMICS PANEL PRESENTATION
James McCoy *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 547-594 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

The Plasma Motor Generator (PMG) concept is explained in detail. The PMG tether systems being used to calculate the estimated performance data is described. The voltage drops and current contact geometries involved in the operation of an electrodynamic tether are displayed illustrating the comparative behavior of hollow cathodes, electron guns, and passive collectors for current coupling into the ionosphere. The basic PMG design involving the massive tether cable with little or no satellite mass at the far end(s) are also described. The Jupiter mission and its use of electrodynamic tethers are given. The need for demonstration experiments is stressed. E.R.

N86-28432*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BEARING DEVELOPMENT PROGRAM FOR A 25 kWe SOLAR-POWERED ORGANIC RANKINE-CYCLE ENGINE
B. Nesmith 15 Sep. 1985 67 p
(Contract NAS7-918; JPL Proj. 5105-146; Contract DE-AM04-80A1-13137)
(NASA-CR-177156; JPL-PUB-85-81; DOE/JPL-1060-92; NAS 1.26:177156) Avail: NTIS HC A04/MF A01 CSCL 13I

The bearing development program is summarized for a 25-kWe power conversion subsystem (PCS) consisting of an organic Rankine-cycle engine, and permanent magnetic alternator (PMA) and rectifier to be used in a 100-kWe point-focusing distributed receiver solar power plant. The engine and alternator were hermetically sealed and used toluene as the working fluid. The turbine, alternator, and feed pump (TAP) were mounted on a single shaft operating at speeds up to 60,000 rev/min. Net thermal-to-electric efficiencies in the range of 21 to 23% were demonstrated at the maximum working fluid temperature of 400 C (750 F). A chronological summary of the bearing development program is presented. The primary causes of bearing wear problems were traced to a combination of rotordynamic instability and electrodynamic discharge across the bearing surfaces caused by recirculating currents from the PMA. These problems were resolved by implementing an externally supplied, flooded-bearing lubrication system and by electrically insulating all bearings from the TAP housing. This program resulted in the successful development of a stable, high-speed, toluene-lubricated five-pad tilting-pad journal bearing and Rayleigh step thrust bearing system capable of operating at all inclinations between horizontal and vertical. Author

N86-28433*# Cincinnati Univ., Ohio. Dept. of Mechanical and Industrial Engineering.
DYNAMIC LOADING ON PARALLEL SHAFT GEARS Final Report
Hsiang-Hsi (Edward) Lin (Memphis State Univ., Tenn.) and Ronald L. Huston Jul. 1986 80 p
(Grant NsG-3188)
(NASA-CR-179473; NAS 1.26:179473; UC-MIE-051586-19) Avail: NTIS HC A05/MF A01 CSCL 13I

A computer-based analysis of the dynamic effects of spur gear systems is presented. The method of analysis with its associated computer code is capable of determining the dynamic response of spur gear systems having involute tooth profiles and standard contact ratios. Various parameters affecting the system dynamic behavior are examined. Numerical results of the analysis are compared with semi-empirical formulae, AGMA (American Gear Manufacturers Association) formulae, and experimental data. A close correlation with the experimental data is obtained. Author

N86-28434*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
SOFTWARE DEVELOPMENT TO SUPPORT SENSOR CONTROL OF ROBOT ARC WELDING Final Report, 16 Apr. 1985 - 8 May 1986
Fred R. Silas, Jr. 8 May 1986 173 p
(Contract NAS8-36460)
(NASA-178865; NAS 1.26:178865; CAM-TR-86-120) Avail: NTIS HC A08/MF A01 CSCL 13H

The development of software for a Digital Equipment Corporation MINC-23 Laboratory Computer to provide functions of a workcell host computer for Space Shuttle Main Engine (SSME) robotic welding is documented. Routines were written to transfer robot programs between the MINC and an Advanced Robotic Cyro 750 welding robot. Other routines provide advanced program editing features while additional software allows communicatin with a remote computer aided design system. Access to special robot functions were provided to allow advanced control of weld seam tracking and process control for future development programs. Author

N86-28435# Army Construction Engineering Research Lab., Champaign, Ill.
RECOMMENDED STAINLESS STEEL WELDING PROCEDURES FOR CORPS OF ENGINEERS CONSTRUCTION Final Report
Robert A. Weber, Steve Hanson, and Marie Bottoms Feb. 1986 21 p
(AD-A165668; CERL-TR-M-86/05) Avail: NTIS HC A02/MF A01 CSCL 13/8

Two stainless steel welding methods are investigated for potential use in Corps of Engineers construction. The methods, gas tungsten-arc welding (GTAW) and shielded metal-arc welding (SMAW), are tested with varying current levels for two stainless steels (types 304 and 316). Comparative analyses are made between test results and standard specifications for the weld's mechanical properties. Test samples also are examined using

metallography and electron microscopy. Results show that GTAW and SMAW provide sound welds in the two stainless steels tested. Moreover, using low-carbon electrodes and filler metal and low currents in the welding process results in low precipitate levels in the heat-affected zone, thus reducing the risk of knifeline corrosion attack. The objective of this work is to investigate current limitations and welding positions that will refine stainless steel pipe welding for field construction and to use this information as a basis for recommending guidance for CE stainless steel welding procedures. GRA

N86-28436# Army Research and Development Command, Dover, N.J. Fire Support Armament Center.
COPPERHEAD CONTAINER LATCH
Paul J. LaCarrubba Feb. 1986 36 p
(AD-A165787; AD-E401458; ARFSD-TR-85004) Avail: NTIS HC A03/MF A01 CSCL 13/4

An improved version of the container latch for the Copperhead M712 projectile is now available. It can be grasped with more comfort, provides the tightest seal possible, and has good shock resistance. Detailed illustrations describe its development. Computer graphics show competing latches under shock load. GRA

N86-28437# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
DESIGN AND DEVELOPMENT OF e3 ANTENNA CONTAINER
Farley T. Hinds 3 Sep. 1985 45 p
(AD-A165804) Avail: NTIS HC A03/MF A01 CSCL 01/3

Warner-Robins ALC/DSTD, Robins AFB GA 31098, requested the Air Force Packaging Evaluation Agency, Wright-Patterson AFB Ohio 45433, to participate as a consultant in the design, development, and testing of a new container for shipping and storage of the E3 Antenna used on the airborne warning and control system (AWACS) aircraft. Evaluation of previous efforts to provide a qualified container revealed a need for substantial changes in the containerization process. The new container must provide not only environmental protection for the E3 Antenna but also shall be transportable by C-5, C-130, or C-141 aircraft. The purpose of this project was to: (1) Design a sealable container for the E3 Antenna; (2) Ensure that the container design was compatible with the C-5, C-130 and C-141 aircraft as well as truck, rail and ship; (3) Establish test plan parameters; (4) Develop reprocurement drawings (level 3); (5) Evaluate the container design and determine any deficiencies; and (6) Deliver a qualified container in nine months. GRA

N86-28438# Oak Ridge National Lab., Tenn.
MANUAL GAS TUNGSTEN ARC (dc) AND SEMIAUTOMATIC GAS METAL ARC WELDING OF 6XXX ALUMINUM. WELDING PROCEDURE SPECIFICATION
C. H. Wodtke, D. R. Frizzell, and W. A. Plunkett Aug. 1985 8 p
(Contract DE-AC05-84OR-21400)
(DE86-001512; ORNL/M-26) Avail: NTIS HC A02/MF A01

Procedure WPS-1009 is qualified under Section IX of the ASME Boiler and Pressure Vessel Code for manual gas tungsten arc (dc) and semiautomatic gas metal arc (dc) welding of aluminum alloys 6061 and 6063 (P-23), in thickness range 0.187 to 2 in.; filler metal is ER4043 (F-23); shielding gases are helium (GTAW) and argon (GMAW). DOE

N86-28439# SKF Industries, Inc., King of Prussia, Pa.
MECHANICAL INTERACTIONS OF ROUGH SURFACES Quarterly Progress Report, 30 Sep. - 31 Dec. 1985
J. I. McCool Jan. 1986 13 p
(Contract DE-AC02-84ER-13163)
(DE86-005778; DOE/ER-13163/9) Avail: NTIS HC A02/MF A01

Measurements of spinning torque as a function of spinning velocity were predicted using an elastic-plastic traction model computer program TRIBOS. Differences are noted depending upon whether the shear stress components in the plastic zone follow the elastically or viscously computed directions. It is found that at high load the viscous version affords a good fit while at low load the elastic version is superior. The behavior of lubricated concentrated contacts involving microscopically rough surfaces is explored under conditions of combined rolling, sliding and spinning with and without the presense of contaminating particles. Processing principles and techniques are being developed for the analysis of digitized rough surface profiles to yield surface descriptors that are predictive of functional performance and which have acceptable systematic and random error. DOE

N86-28440# European Space Tribology Lab., Risley (England).
PERFORMANCE AND LIFE TESTING OF MOTOR GEARHEADS
J. C. Anderson Paris ESA Jan. 1985 45 p Revised
(Contract ESTEC-5615/83-NL-PP)
(ESA-ESTL-68; ESA-CR(P)-2158; ESA-86-96860) Avail: NTIS HC A03/MF A01

A size 11 permanent magnet motor, and 2 size 18 precision gearheads were subjected to air and vacuum performance tests and accelerated life testing. Each gearhead was lubricated with a different perfluoropolyether-based grease, namely Braycote 3L-38-RP and Fomblin Y VAC 3. The gearheads and the motor perform satisfactorily in air, and in vacuum over a range of temperatures from +85C to -45C, except that the gearhead lubricated with Y VAC 3 exhibits a higher current consumption for the same ouptut torque at -45C compared with the Braycote-lubricated unit. The Braycote-lubricated gearhead accumulated 61 hr of operation in air and 15 hr 10 min in vacuum. The motor, fitted with graphite-based brushes, accumulated 61 hr 20 min running in air and 33 hr 50 min in vacuum, but the brushes were severely worn. ESA

N86-28441# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
ENVIRONMENTAL ASSESSMENT OF A RECIPROCATING ENGINE RETROFITTED WITH SELECTIVE CATALYTIC REDUCTION. VOLUME 2: DATA SUPPLEMENT Final Report, Mar. - Dec. 1984
C. Castaldini and L. R. Waterland Apr. 1986 72 p
(Contract EPA-68-02-3188)
(PB86-183787; EPA/600/7-86/014B) Avail: NTIS HC A04/MF A01 CSCL 21G

Results of comprehensive emission measurements and 15-day continuous emission monitoring for a 1,500 kW (2000 hp) gas-fired, four-stroke turbocharged reciprocating engine equipped with an ammonia-based selective catalytic reduction system for NOx control are given. A data supplement is included. GRA

N86-28442# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
ENVIRONMENTAL ASSESSMENT OF A RECIPROCATING ENGINE RETROFITTED WITH SELECTIVE CATALYTIC REDUCTION. VOLUME 1: TECHNICAL RESULTS Final Report, Mar. - Dec. 1984
C. Castaldini and L. R. Waterland Apr. 1986 71 p
(Contract EPA-68-02-3188)
(PB86-183779; EPA/600/7-86/014A) Avail: NTIS HC A04/MF A01 CSCL 21G

Results of comprehensive emission measurements and 15-day continuous emission monitoring for a 1,500 kW (2000 hp) gas-fired, four-stroke turbocharged reciprocating engine equipped with an ammonia-based selective catalytic reduction system for NOx control are given. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-28443 Kema N.V., Arnhem (Netherlands).
NONDESTRUCTIVE TESTING (NDT) IN THE NETHERLANDS 1982-85

M. G. vanDijk Oct. 1985 52 p
(WSK/98001-38; ESA-86-96663) Copyright. Avail: Issuing Activity

Nondestructive testing (NDT) in the Dutch aerospace, oil, process, and power generation industries is reviewed. Test facilities and institutes involved in NDT are described. ESA

N86-28444# Royal Armament Research and Development Establishment, Fort Halstead (England). Mathematics and Assessment Group.

RELIABILITY. PART 1: ATTRIBUTES DATA

J. Bendall 1984 46 p
(Rept-20/84-Pt-1; BR93984; ESA-86-97112) Avail: NTIS

An approach to the assessment of system reliability, based on attributes data, is described. Techniques for handling general multicomponent systems are presented. ESA

N86-28445*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

A STUDY OF THE STRESS WAVE FACTOR TECHNIQUE FOR NONDESTRUCTIVE EVALUATION OF COMPOSITE MATERIALS Final Report

A. Sarrafzadeh-Khoee, M. T. Kiernan, J. C. Duke, Jr., and E. G. Henneke, II Washington NASA Jul. 1986 33 p
(Grant NAG3-172)
(NASA-CR-4002; E-3081; NAS 1.26:4002) Avail: NTIS HC A03/MF A01 CSCL 14D

The acousto-ultrasonic method of nondestructive evaluation is an extremely sensitive means of assessing material response. Efforts continue to complete the understanding of this method. In order to achieve the full sensitivity of the technique, extreme care must be taken in its performance. This report provides an update of the efforts to advance the understanding of this method and to increase its application to the nondestructive evaluation of composite materials. Included are descriptions of a novel optical system that is capable of measuring in-plane and out-of-plane displacements, an IBM PC-based data acquisition system, an extensive data analysis software package, the azimuthal variation of acousto-ultrasonic behavior in graphite/epoxy laminates, and preliminary examination of processing variation in graphite-aluminum tubes. Author

N86-28446# NDT Technologies, Inc., South Windsor, Conn.

ELECTROMAGNETIC INSPECTION OF WIRE ROPES USING SENSOR ARRAYS Final Report, 16 Jun. 1983 - 15 Jun. 1985

Herbert R. Weischedel 20 Dec. 1985 93 p
(Contract N00014-83-C-0484)
(AD-A165681) Avail: NTIS HC A05/MF A01 CSCL 14/2

The Program Objective was to develop a technique and apparatus for a reliable inspection of wire ropes in service. In particular, the objective was to develop advanced methods and apparatus for an accurate quantitative in-service identification and characterization of wire rope defects using electromagnetic NDE methods. A line of electromagnetic instruments was developed. These instruments can reliably test wire ropes in service, and they can remedy the shortcomings of previous wire rope inspection methods. The new instruments allow a quantitative determination of loss of metallic cross-sectional area (LMA) caused by localized flaws (e.g., broken wires) and by distributed flaws (e.g., corrosion or abrasion) with a quantitative resolution of 50 mm. (Here, quantitative resolution is defined as the required minimum flaw length for which the sensor provides a quantitative measure of LMA directly, without additional signal processing).The qualitative identification of flaws shorter than 50 mm is possible without further signal processing. GRA

N86-28447# Karlsruhe Univ. (West Germany). Inst. Fuer Zuverlaessigkeit und Schadenskunde in M

FRACTURE MECHANIC EVALUATION OF NONDESTRUCTIVELY DETECTED FLAWS IN CERAMIC MATERIALS Final Report, Oct. 1984

Ottmar Rosenfelder and Dietrich Munz Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 76 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-148; ISSN-0340-7608; ESA-86-96897) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

The effect of flaws such as pores, inclusions, and cracks on the failure of ceramic materials is discussed. Flaw assessment was based on nondestructive and fractographic evaluation. It is shown that all flaws > 360 micron diameter can be detected nondestructively. For smaller flaws, the detection probability is < 1. For the prediction of failure strength the stress intensity factor for different flaw configuration was calculated. Pores, approximately described by spheres, were described by two-dimensional cracks; this is not possible for elongated pores. If the pores are described by spheres or hemispheres with circumferential cracks, a crack length much larger than the grain size has to be assumed. The behavior of inclusion depends on the thermal expansion coefficent of inclusion and matrix. ESA

N86-28448# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. des Systemes Balistiques et Spatiaux.

THE QUALITY OF AEROSPACE MATERIALS ENVIRONMENTAL TESTS [LA QUALITE DES ESSAIS EN ENVIRONNEMENT POUR LES MATERIES AEROSPATIAUX (RECOMMANDATION RG AERO 00011 ELABOREE PAR LE BNAE)]

Bertrand Rosenau 1986 21 p In FRENCH
(SNIAS-861-422-103; ESA-86-97160) Avail: NTIS HC A02/MF A01

The test quality in mechanical, climate, electrical, and radioelectrical environments is discussed. The evaluation of the test quality and the interactions between the user and the control laboratory to establish an efficient test system are examined for the different phases of the system implementation, including design, experimental set-up, execution and formulation of the test results. ESA

N86-28449# Food and Drug Administration, Rockville, Md. Center for Devices and Radiological Health.

COMPUTER TOMOGRAPHY TECHNIQUES AND QUALITY ASSURANCE PROGRAMS IN THE MID-1980's Final Report

J. L. McCrohan, J. F. Patterson, R. L. Burkhart, H. A. Goldstein, and F. G. Shuman Mar. 1986 74 p
(PB86-182508; HHS/PUB-FDA-86-8258; FDA/CDRH-86/113) Avail: NTIS HC A04/MF A01 CSCL 06L

The Center for Devices and Radiological Health (CDRH) has been concerned for some time about a variety of issues related to the practice of computed tomography (CT). To obtain information on two of those issues, how CT systems are used in practice and the extent and nature of quality assurance activities, CDRH negotiated contracts for the collection of data with 21 States during Fiscal Years '83 and '84. In 421 surveys, data were gathered on 40 different CT system models manufactured by 11 different firms. The report presents an analysis of the data collected. The general conclusions drawn from the data are also presented in the report. GRA

N86-28450# Battelle Columbus Labs., Ohio.

EVALUATIONS AND UTILIZATIONS OF RISK IMPORTANCES

W. E. Vesely and T. C. Davis Aug. 1986 130 p
(Contract NRC-FIN-D-1106)
(TI85-902167; NUREG/CR-4377; BMI-2129) Avail: NTIS HC A07/MF A01

Approaches for utilizing Probabilistic Risk Analyses (PRA's) to determine risk importances are discussed. Risk importances are determined for design features, plant operations, and other factors that can affect risk. PRA's can be used to identify the importances of risk contributors or proposed changes to designs or operations. The objective here is to provide guidance in evaluating and applying risk importances. The utilization of both qualiltative risk importances and quantitative risk importances is described. Qualitative risk importances are based on the logic models in the PRA, while quantitative risk importances are based on the quantitative results of the PRA. Both types of importances are among the most robust

and meaningful information a PRA can provide. A wide variety of risk importance evaluations are described including evaluations of the importances of design changes, testing, maintenance, degrading environments, and aging. Specific utilizations are described in inspection and in reliability assurance programs. However, the general approaches have widespread applicability. The role of personal computers and decision support programs in applying risk importance evaluations are also described. Author

N86-28451 United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
THE DEVELOPMENT AND USE OF ELECTROCHEMICAL POTENTIAL MONITORING IN ENVIRONMENT ASSISTED CRACKING TESTS IN HIGH TEMPERATURE, HIGH PRESSURE, AQUEOUS ENVIRONMENTS
P. M. Scott and W. H. Bamford Oct. 1985 21 p
(AERE-R-11741) Copyright. Avail: NTIS HC A02/MF A01

The results of corrosion fatigue and stress corrosion studies of pressure boundary steels in LWR type environments have often exhibited significant interlaboratory variability. One measurement that has proved essential in helping to resolve these differences has been the corrosion potential of the test specimens achieved in various test rigs. The International Co-operative Group on Cyclic Crack Growth Rate Testing and Evaluation (the ICCGR Group), as part of its activities, has collated measurements of corrosion potentials and has been able to monitor the reliability and longevity of various reference electrodes thought to be suitable for high temperature (up to 290 deg C) aqueous environments. These measurements are reviewed. Recommendations are given for the most suitable reference electrode designs for BWR and PWR primary water environments. Author

N86-28452# Institute of Gas Technology, Chicago, Ill.
FIELD-TESTING RESULTS ON THE SONIC LEAK PINPOINTER
James E. Huebler, Christopher J. Ziolkowski, Stuart B. Eynon, and L. L. Altpeter, Jr. 1985 25 p Presented at the American Gas Association Distribution Conference Operating Section, Boston, Mass., 20-22 May 1985
(TI86-900902; CONF-8505237-3) Avail: NTIS HC A02/MF A01

The field testing results on the sonic leak pinpointer for medium and high pressure gas distribution systems are discussed. The sonic leak pinpointer is a supplement to conventional leak pinpointers by means of which false excavations can be eliminated. During the field testing, currently available pinpointing techniques (including the combustible gas indicator) accurately pinpointed leaks at 74% of the sites. The addition of the sonic leak pinpointer to these techniques increased the accurate pinpointing to 97% of the sites, an improvement of 23%. Accurate pinpointing is defined as + or - 2 feet, ensuring that the leak is in the first bell hole excavated. Uses for the pinpointer and the general procedure for using the instrument are also discussed. The current results demonstrate that the sonic leak pinpointer has a payback period of less than two months. Author

N86-28250*# Aerojet Technical Systems Co., Sacramento, Calif.
LONGITUDINAL MODE COMBUSTION INSTABILITIES OF A HIGH-PRESSURE FUEL-RICH LOX/RP-1 PREBURNER
J. J. Fang *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 429-441 (For primary document see N86-28212 19-28)
(Contract NAS3-22647)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-28453 ESDU International Ltd., London (England).
CIRCULAR-CYLINDRICAL STRUCTURES: DYNAMIC RESPONSE TO VORTEX SHEDDING. PART 2: SIMPLIFIED CALCULATION PROCEDURES
Dec. 1985 36 p
(ESDU85039; ISBN-0-85679-545-3; ISSN-0143-2702) Avail: ESDU

Simplified procedures with charts for estimating across-wind deflection of cantilever structures such as stacks, towers, and process columns are given (ESDU Report 85039).The methods are derived from the full procedure in a previous report (ESDU 85038) but are simplified by using pre-determined values of the across-wind force coefficient and Strouhal number. They apply to parallel-sided, tapered and stepped structures and structures with efficient aerodynamic spoilers, and only require knowledge of the mass, natural frequency and dimensions of the structure. The procedures, for which calculation sheets are included, predict maximum amplitude (at critical wind speed), and response at off-critical wind speeds. The loss of accuracy resulting from the simplifications compared with the full procedure is within the overall uncertainty of the method and gives predictions that are certainly adequate for most engineering calculations. Worked examples illustrate the use of the methods. A subsequent report (ESDU 85040) gives a computer program for the calculation of response using the full method of the previous report (ESDU 85038). Author

N86-28454# Royal Aircraft Establishment, Farnborough (England).
PREDICTION OF STRESS DISTRIBUTIONS IN FATIGUE SPECIMENS BY FINITE ELEMENT ANALYSIS
C. G. Burton, T. J. W. Ward, and S. R. Cockrem 26 Apr. 1985 18 p
(RAE-TM-P-1054; BR96735; ESA-86-97106) Avail: Issuing Activity

An elastoplastic finite element code was used to analyze the stress fields in a notch bend fatigue specimen and a model gas turbine disk. A range of solution algorithms was employed. The quickest is the initial stiffness algorithm in which the structural stiffness matrix remains constant throughout the analysis. Attempts to improve the convergence rate of the iterative solution procedure by using Crisfield's acceleration technique were unsuccessful. The model disk results show good correlations between the observed crack initiation sites and the predicted location of maximum principal stress thus improving confidence in the accuracy of the analysis. The predicted stresses for the model disk and notch bend specimen were used successfully to correlate experimental crack initiation and growth data. ESA

N86-28455*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
INTEGRATED RESEARCH IN CONSTITUTIVE MODELLING AT ELEVATED TEMPERATURES, PART 2 Final Report
W. E. Haisler and D. H. Allen Jun. 1986 224 p
(Grant NAG3-491)
(NASA-CR-177233; NAS 1.26:177233; MM-4998-86-13-Pt-2) Avail: NTIS HC A10/MF A01 CSCL 20K

Four current viscoplastic models are compared experimentally with Inconel 718 at 1100 F. A series of tests were performed to create a sufficient data base from which to evaluate material constants. The models used include Bodner's anisotropic model; Krieg, Swearengen, and Rhode's model; Schmidt and Miller's model; and Walker's exponential model. For individual titles, see N86-28456 through N86-28460.

N86-28456*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
OVERVIEW OF MODELS
In its Integrated Research in Constitutive Modelling at Elevated Temperatures, Part 2 Jun. 1986 p 16-125 (For primary document see N86-28455 19-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The thermodynamic framework of internal state variables are briefly described. The general form of viscoplastic models is

discussed. Tests used as input to calculate material constants for viscoplastic models are covered. The standard tests included creep tests, stress relaxation tests, monotonic strain rate tests, fully reversed cyclic tests, transient tests during monotonic loading, and transient tests during cyclic loading. The test equipment is also described. B.G.

N86-28457*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
DATA SET
In its Integrated Research in Constitutive Modelling at Elevated Temperatures, Part 2 Jun. 1986 p 126-135 (For primary document see N86-28455 19-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The calculations used in the viscoplasticity models were repeated and upgrades to the methods used were developed. The data are presented in tabular form. B.G.

N86-28458*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
PROPOSED INITIAL CALCULATION METHODS
In its Integrated Research in Constitutive Modelling at Elevated Temperatures, Part 2 Jun. 1986 p 136-148 (For primary document see N86-28455 19-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The proposed methods are summarized using a generic viscoplastic model. The following initial assumptions were made: back stress was assumed responsible for hardening in monotonic tension; drag stress was assumed responsible for cyclic softening; thermal recovery effects were small and masked by solute strengthening effects; and solute strengthening or strain aging masked the basic positive strain rate sensitivity of the material. Each of the four models used is then explained. B.G.

N86-28459*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
AUXILIARY MODEL RESULTS
In its Integrated Research in Constitutive Modelling at Elevated Temperatures, Part 2 Jun. 1986 p 149-174 (For primary document see N86-28455 19-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The experimental results for the first half cycle of the cyclic tests and the long term tension tests are presented. The model predictions for these results are provided and the numerical instabilities are examined. B.G.

N86-28460*# Texas A&M Univ., College Station.
EXPERIMENTAL COMPUTER PROGRAMS
In its Integrated Research in Constitutive Modelling at Elevated Temperatures, Part 2 Jun. 1986 p 175-215 (For primary document see N86-28455 19-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The test software developed for the viscoplasticity modeling is presented. All programs are written in MTS Basic. Program VCYC6 allows the user to run cyclic tests, monotonic tension test, and cyclic tests with creep hold times. Program CRP3 performs creep tests and creep stress drop tests. Program BACK2 allows the user to analyze cyclic creep hold time data on creep stress drop data. The program does a linear regression curve fit through the data. The number of points used for the curve is chosen for each step. Program GMPLT8 analyzes each test with the gamma plot. The stress inelastic strain history is calculated and a stress-inelastic strain polynomical curve fit performed. Program WALK2 performs the same function with the theta plot. B.G.

N86-28461*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRUCTURAL ANALYSIS OF TURBINE BLADES USING UNIFIED CONSTITUTIVE MODELS
A. Kaufman, M. Tong, J. F. Saltsman, and G. R. Halford 1986 12 p Proposed for presentation at the International Conference on Computers in Engine Technology, Cambridge, England, 24-27 Mar. 1987; sponsored by the Institution of Mechanical Engineers (NASA-TM-88807; E-3155; NAS 1.15:88807) Avail: NTIS HC A02/MF A01 CSCL 20K

The utility of advanced constitutive models and structural analysis methods in predicting the cyclic life of an air-cooled turbine blade is assessed. Five structural analysis methods were exercised in calculating the cyclic stress-strain response at the airfoil critical location. The methods studied were a cyclic elastic finite-element analysis, nonlinear finite-element analyses based on classical inelastic models and the unified models of Bodner and Walker, and a simplified inelastic procedure. These analyses were compared in terms of computing times and of predicted crack initiation lives using the Strainrange Partitioning method. Author

N86-28462*# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
FORMULATION OF THE NONLINEAR ANALYSIS OF SHELL-LIKE STRUCTURES, SUBJECTED TO TIME-DEPENDENT MECHANICAL AND THERMAL LOADING Interim Technical Report, 15 Apr. 1984 - 14 Apr. 1986
George J. Simitses, Robert L. Carlson, and Richard Riff 28 Jul. 1986 178 p
(Grant NAG3-534)
(NASA-CR-177194; NAS 1.26:177194) Avail: NTIS HC A09/MF A01 CSCL 20K

A general mathematical model and solution methodologies for analyzing the structural response of thin, metallic shell structures under large transient, cyclic, or static thermomechanical loads was sought. Among the system responses associated with these loads and conditions are thermal buckling, creep buckling, and ratcheting. Thus geometric and material nonlinearities (of high order) can be anticipated and must be considered in developing the mathematical model. A complete, true ab-initio rate theory of kinematics and kinetics for continuum ad curved thin structures, without any restriction on the magnitude of the strains or the deformations, was formulated. The time dependence and large strain behavior are incorporated through the introduction of the time rates of metric and curvature in two coordinate systems: fixed (spatial) and convected (material). The relations between the time derivative and the covariant derivative (gradient) was developed for curved space and motion, so the velocity components supply the connection between the equations of motion and the time rates of change of the metric and curvature tensors. A time and temperature dependent viscoplasticity model was formulated to account for finite strains and rotations. Author

N86-28463*# Aerostructures, Inc., Arlington, Va.
NASTRAN SUPPLEMENTAL DOCUMENTATION FOR MODAL FORCED VIBRATION ANALYSIS OF AERODYNAMICALLY EXCITED TURBOSYSTEMS
V. Elchuri and P. R. Pamidi (RPK Corp., Columbia, Md.) Jul. 1985 133 p
(Contract NAS3-24387)
(NASA-CR-174967; NAS 1.26:174967) Avail: NTIS HC A07/MF A01 CSCL 20K

This report is a supplemental NASTRAN document for a new capability to determine the vibratory response of turbosystems subjected to aerodynamic excitation. Supplements to NASTRAN Theoretical, User's, Programmer's, and Demonstration Manuals are included. Turbosystems such as advanced turbopropellers with highly swept blades, and axial-flow compressors and turbines can be analyzed using this capability, which has been developed and implemented in the April 1984 release of the general purpose finite element program NASTRAN. The dynamic response problem is addressed in terms of the normal modal coordinates of these tuned rotating cyclic structures. Both rigid and flexible hubs/disks are considered. Coriolis and centripetal accelerations, as well as differential stiffness effects are included. Generally non-uniform steady inflow fields and uniform flow fields arbitrarily inclined at small angles with respect to the axis of rotation of the turbosystem are considered as the sources of aerodynamic excitation. The spatial non-uniformities are considered to be small deviations from a principally uniform inflow. Subsonic and

supersonic relative inflows are addressed, with provision for linearly interpolating transonic airloads. Author

N86-28464*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL-FATIGUE AND OXIDATION RESISTANCE OF COBALT-MODIFIED UDIMET 700 ALLOY
Peter T. Bizon and Betty J. Barrow Apr. 1986 15 p
(NASA-TP-2591; E-2704; NAS 1.60:2591) Avail: NTIS HC A02/MF A01 CSCL 20K

Comparative thermal-fatigue and oxidation resistances of cobalt-modified wrought Udimet 700 alloy (obtained by reducing the cobalt level by direct substitution of nickel) were determined from fluidized-bed tests. Bed temperatures were 1010 and 288 C (1850 and 550 C) for the first 5500 symmetrical 6-min cycles. From cycle 5501 to the 14000-cycle limit of testing, the heating bed temperature was increased to 1050 C (1922 F). Cobalt levels between 0 and 17 wt% were studied in both the bare and NiCrAlY overlay coated conditions. A cobalt level of about 8 wt% gave the best thermal-fatigue life. The conventional alloy specification is for 18.5% cobalt, and hence, a factor of 2 in savings of cobalt could be achieved by using the modified alloy. After 13500 cycles, all bare cobalt-modified alloys lost 10 to 13 percent of their initial weight. Application of the NiCrAlY overlay coating resulted in weight losses of 1/20 to 1/100 of that of the corresponding bare alloy. Author

N86-28465*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIGRID METHODS IN STRUCTURAL MECHANICS
I. S. Raju (Analytical Services and Materials, Inc., Hampton, Va.), C. A. Bigelow, S. Taasan, and M. Y. Hussaini Jul. 1986 60 p
(Contracts NAS1-17808; NAS1-17070)
(NASA-TM-87761; NAS 1.15:87761) Avail: NTIS HC A04/MF A01 CSCL 20K

Although the application of multigrid methods to the equations of elasticity has been suggested, few such applications have been reported in the literature. In the present work, multigrid techniques are applied to the finite element analysis of a simply supported Bernoulli-Euler beam, and various aspects of the multigrid algorithm are studied and explained in detail. In this study, six grid levels were used to model half the beam. With linear prolongation and sequential ordering, the multigrid algorithm yielded results which were of machine accuracy with work equivalent to 200 standard Gauss-Seidel iterations on the fine grid. Also with linear prolongation and sequential ordering, the V(1,n) cycle with n greater than 2 yielded better convergence rates than the V(n,1) cycle. The restriction and prolongation operators were derived based on energy principles. Conserving energy during the inter-grid transfers required that the prolongation operator be the transpose of the restriction operator, and led to improved convergence rates. With energy-conserving prolongation and sequential ordering, the multigrid algorithm yielded results of machine accuracy with a work equivalent to 45 Gauss-Seidel iterations on the fine grid. The red-black ordering of relaxations yielded solutions of machine accuracy in a single V(1,1) cycle, which required work equivalent to about 4 iterations on the finest grid level. Author

N86-28466*# Lehigh Univ., Bethlehem, Pa.
THE CRACK PROBLEM IN A REINFORCED CYLINDRICAL SHELL
O. Selcuk Yahsi and F. Erdogan Jun. 1986 36 p
(Grant NGR-39-007-011)
(NASA-CR-178140; NAS 1.26:178140) Avail: NTIS HC A03/MF A01 CSCL 20K

A partially reinforced cylinder containing an axial through crack is considered. The reinforcement is assumed to be fully bonded to the main cylinder. The composite cylinder is thus modelled by a nonhomogeneous shell having a step change in the elastic properties at the z = 0 plane, z being the axial coordinate. Using a Reissner type transverse shear theory the problem is reduced to a pair of singular integral equations. In the special case of a crack tip touching the bimaterial interface it is shown that the dominant parts of the kernels of the integral equations associated with both membrane loading and bending of the shell reduce to the generalized Cauchy kernel obtained for the corresponding plane stress case. The integral equations are solved and the stress intensity factors are given for various crack and shell dimensions. A bonded fiberglass reinforcement which may serve as a crack arrestor is used as an example. M.G.

N86-28467*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
J-INTEGRAL ESTIMATES FOR CRACKS IN INFINITE BODIES Final Report
N. E. Dowling Jul. 1986 42 p
(Grant NAG3-438)
(NASA-CR-179474; NAS 1.26:179474) Avail: NTIS HC A03/MF A01 CSCL 20K

An analysis and discussion is presented of existing estimates of the J-integral for cracks in infinite bodies. Equations are presented which provide convenient estimates for Ramberg-Osgood type elastoplastic materials containing cracks and subjected to multiaxial loading. The relationship between J and the strain normal to the crack is noted to be only weakly dependent on state of stress. But the relationship between J and the stress normal to the crack is strongly dependent on state of stress. A plastic zone correction term often employed is found to be arbitrary, and its magnitude is seldom significant. Author

N86-28468*# Lehigh Univ., Bethlehem, Pa.
LINE SPRING MODEL AND ITS A-PPLICATIONS TO PART-THROUGH CRACK PROBLEMS IN PLATES AND SHELLS
F. Erdogan and B. Aksel Jun. 1986 44 p SPONSORED BY Lehigh Univ.,Bethlehem, Pa.
(Grant NGR-39-007-011)
(NASA-CR-178141; NAS 1.26:178141) Avail: NTIS HC A03/MF A01 CSCL 20K

The line spring model is described and extended to cover the problem of interaction of multiple internal and surface cracks in plates and shells. The shape functions for various related crack geometries obtained from the plane strain solution and the results of some multiple crack problems are presented. The problems considered include coplanar surface cracks on the same or opposite sides of a plate, nonsymmetrically located coplanar internal elliptic cracks, and in a very limited way the surface and corner cracks in a plate of finite width and a surface crack in a cylindrical shell with fixed end. M.G.

N86-28469# California Univ., Los Angeles. School of Engineering and Applied Science.
SHEAR STRESS-STRAIN RELATION OBTAINED FROM TORQUE-TWIST DATA Interim Report
S. B. Batdorf and Robert W. C. Ko 1 Jan. 1986 11 p
(Contract N00014-85-K-0667)
(AD-A165598; UCLA-ENG-86-41) Avail: NTIS HC A02/MF A01 CSCL 20/11

One method of establishing the shear stress-strain relation of a material involves applying torsion to a circular cylinder. This approach has the advantage of experimental simplicity, but the disadvantage that the specimen is nonuniformly loaded, thus requiring a somewhat sophisticated data analysis. Fortunately the required analysis has already been worked out for the case of solid cylinders made of an isotropic elastic material. Such an analysis was furnished by Nadal. Unfortunately, sometimes only an approximate analysis is performed, and results are only reported as the resulting approximate shear stress-strain relation. Fortunately however, as we shall show, this type of approximate result can be easily corrected to get the proper result without having to go back to the original torque-twist data, which may no longer be available. A second contribution of the paper is to extend the analysis to the case of hollow cylinders. A third is to call attention to the fact that some cases of combined loads can also be analyzed in essentially the same manner. oblem, and serves as the basis of the extension to hollow cylinders. GRA

N86-28470# Kansas State Univ., Manhattan. Dept. of Civil Engineering.
APPLICABILITY OF FRACTURE MECHANICS METHODOLOGY TO CRACKING AND FRACTURE OF CONCRETE Interim Report, Oct. 1984 - Sep. 1985
Stuart E. Swartz Feb. 1986 212 p
(Contract N62583-85-M-T239; NR Proj. ZR0-2303)
(AD-A165639; NCEL-CR-86.006) Avail: NTIS HC A10/MF A01 CSCL 13/2

This report contains a state-of-the-art summary of past and current research activities in the application of fracture mechanics methodologies to cracking and fracture of concrete. A fracture model to determine the fracture process in concrete is discussed. Despite known problems, it is recommended that linear elastic fracture mechanics provides a suitable model. A detailed testing procedure and data evaluation are given using a three-point-loaded cracked beam specimen. GRA

N86-28471# Texas A&M Univ., College Station. Mechanics and Materials Research Center.
THE DYNAMIC ENERGY RELEASE RATE FOR A STEADILY PROPAGATING ANTI-PLANE SHEAR CRACK IN A LINEARLY VISCOELASTIC BODY
Jay R. Walton Jan. 1986 26 p
(Contract N00014-83-K-0211)
(AD-A165654; MM-4867-86-3) Avail: NTIS HC A03/MF A01 CSCL 20/11

The steady-state propagation of a semi-infinte, anti-plane shear crack is reconsidered for a general, infinite, homogeneous and isotropic linearly viscoelastic body. As with an earlier study, the inertial term in the equation of motion is retained and the shear modulus is only assumed to be positive, continuous, decreasing and convex. A Barenblatt type failure zone is introduced in order to cancel the singular stress, and a numerically convenient expansion for the dynamic Energy Release Rate (ERR) is derived for a rather general class of crack face loadings. The ERR is shown to have a complicated dependence on crack speed material properties with significant qualitative differences between viscoelastic and elastic material. The results are illustrated with numerical calculations for both power-law material and a standard linear solid. GRA

N86-28472# Texas A&M Univ., College Station. Mechanics and Materials Center.
THE QUASI-STATIC PROPAGATION OF A PLANE STRAIN CRACK IN A POWER-LAW INHOMOGENEOUS LINEARLY VISOELASTIC BODY
Lawrence Schovanec and Jay R. Walton Jan. 1986 28 p
(Contract N00014-83-K-0211)
(AD-A165714; MM-4867-86-4) Avail: NTIS HC A03/MF A01 CSCL 20/11

An analysis is presented of the steady-state propagation of a semi-infinite mode I crack for an infinite inhomogeneous, linearly viscoelastic body. The shear modulus is assumed to have a power-law dependence on depth from the plane of the crack. Moreover, both a general and a power-law behavior in time for the shear modulus are considered. A simple closed form expression for the normal component of stress in front of the propagating crack is derived which exhibits explicitly the form of the stress singularity and its material dependency. The crack profile is examined and its dependence on the spatial and time behavior of the shear modulus is determined. GRA

N86-28473# Aeronautical Research Labs., Melbourne (Australia).
NUMERICAL COMPLIANCE AND STRESS INTENSITY FACTOR CALIBRATIONS OF MRL (MATERIALS RESEARCH LABORATORIES) COMPACT SPECIMENS
M. Heller and J. Paul Nov. 1985 26 p
(AD-A165833; ARL/STRUC-TM-421) Avail: NTIS HC A03/MF A01 CSCL 20/11

The fracture mechanics parameters K sub IC (the plane strain fracture toughness) and J sub IC (the critical value of the J integral) characterise the resistance of a material to cracking for elastic and elastic-plastic conditions at the crack tip respectively. Standard specimen configurations are available for K sub IC and J sub IC testing, and these are given in ASTM standards E-399 and E-813 respectively. At Materials Research Laboratories, Melbourne, a compact specimen design has been developed which has been found to be suitable for both K sub IC and J sub IC testing. For determining K sub IC, a stress intensity factor (K) calibration is required for the specimen, and for determining J sub IC using the single specimen technique, a compliance calibration is needed. This memorandum describes these calibrations, which were obtained using finite element analyses, and gives equations which have been fitted to the results for convenience. GRA

N86-28474# Science Applications International Corp., McLean, Va.
MOVING FINITE ELEMENT CODES IN ONE AND TWO DIMENSIONS Final Report
Adam Drobot, Martin Fritts, Curtis Menyuk, Robert Gelinas, and Said Doss 1 Oct. 1985 103 p
(Contract DE-AC05-81ER-10858)
(DE86-006185; SAIC-85/1845) Avail: NTIS HC A06/MF A01

Many problems in physics necessitate the solution of equations which develop sharp gradients, such as shocks. To deal with this situation, methods are needed which place a high density of nodes in the neighborhoods of the steep gradients. One of the most promising of these methods is the moving finite element method. This approach, in which the nodes are moved so as to minimize the residual error was used successfully to study several different one dimensional problems and show great promise as well in dealing with two dimensions. The principal two dimensional problems which were examined include: a gas dynamic problem with a reflecting planar shock, Burger's equation in two dimensions, the Stefan problem, and a gas dynamics problem with a shock incident on a wedge boundary. B.G.

N86-28475# Technical Research Centre of Finland, Espoo.
ELASTIC-PLASTIC ANALYSIS OF FRACTURE MECHANICS TEST SPECIMENS, PART 2
H. Talja and K. Wallin Dec. 1984 110 p In FINNISH
(DE86-700156; VTT-TUTK-329) Avail: NTIS (US Sales Only) HC A06/MF A01

This is the second part of the report of the research program Comparisons between computational and experimental elastic-plastic results. The first part was reported earlier and contained a two dimensional linear elastic finite element analysis of four specimen geometries and testing and elastic-plastic analyses of the specimen. The second part of the program containing the testing and 2-D elastic-plastic analyses of five specimens is described. The four specimen geometries mentioned above and two different materials (stainless steel AISI 304 and ferrite pressure vessel steel A533B) are considered. The following comparisons are presented: load vs. load displacement curves, J-integral, crack opening displacement (COD), J vs. COD and the size of the plastic zone. The agreement between the computational and experimental results is quite good. Complete agreement can be achieved only with 3 dimensional calculation models. Author

N86-28476# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
VARIATIONAL APPROACH FOR PREDICTING THE LOAD DEFORMATION RESPONSE OF A DOUBLE STRETCHED MEMBRANE REFLECTOR MODULE
L. M. Murphy Oct. 1985 60 p
(DE85-016873; SERI/TR-253-2626) Avail: NTIS HC A04/MF A01

A report presents an analytical model useful for design and sizing purposes to describe the load deformation response of a stretched membrane reflector module structural system. The major problem addressed is that of a double membrane module which is uniformly loaded normal to the membrane surface. The membranes are attached to a frame which is held fixed by periodic simple supports. The current model predicts the coupled membrane/frame response and considers the in-plane stiffness effect

of the membrane and nonuniform tension states in the membrane; the effect of different attachment schemes; and the impact of double-membrane designs. The tension increments in the membrane are assumed to be small compared to the initial membrane pre-tension. The model developed in this report is based on an incremental variational approach where large deformation, small strain theories are assumed. The Rayleigh Ritz procedure and a formalism similar to that used in finite element analyses are employed in describing the system stiffness. Increased system structural stiffness is shown to accrue with the coupled double membrane frame system by virtue of the roll restraint and frame bending rigidity enhancements (analogous to the due to due to a flange section) offered to the frame by the membrane. Results are compared with predictions using detailed finite element analyses. DOE

N86-28477# Los Alamos National Lab., N. Mex.
DISCUSSION OF MATERIAL ROTATION AND STRESS RATE
J. K. Dienes Oct. 1985 17 p
(Contract W-7405-eng-36)
(DE86-005865; LA-10530-MS) Avail: NTIS HC A02/MF A01

Characterization of material behavior can be divided into two parts, the analysis of deformation and the underlying physics, though these are intimately related. A significant advance in the analysis of deformation was made when the polar decomposition theorem was introduced, making it possible to separate large deformations into a stretch and a rotation. Consequences of the theorem affect the way rate processes should be characterized. In particular, rate of material rotation is different from vorticity, and the stress rate for finite strains is different from the usual stress rate of Zaremba, Jaumann, and Noll. It is convenient to define a strain rate that is different from the stretching that is the symmetric part of the velocity gradient. These concepts are described in detail in a 1979 paper. Various criticisms of that paper have appeared in the Journal of Applied Mechanics, which are discussed herein. To illustrate the distinction, it is shown that the rate of rotation in a classical vortex does not vanish, though the vorticity is zero. It is also shown that the rate of material rotation recently computed by Nemat-Nasser, which involves an eigenvalue expansion, is equivalent to the one given in the 1979 paper, which makes use of matrix inversion, and it asseverated that the matrix inversion approach is computationally more efficient. DOE

N86-28478# Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
IMPLEMENTATION OF AXISYMMETRIC FINITE ELEMENTS IN STRUDL V2 M8
C. F. Vrijman Nov. 1983 56 p
(ICES-STRUDL-83-15; B8575351; ESA-86-96671) Avail: NTIS HC A04/MF A01

A computer program for stress analysis in bodies of revolution under axisymmetric loading is listed. ESA

N86-28479# Technische Hogeschool, Delft (Netherlands). Transportkunde.
PULSATION TESTS ON A SOCKET FAST CASTED MOLD SOCKET [PULSATIEPROEVEN OP EEN MET SOCKET FAST INGEGOTEN FIETSOK]
G. C. Meeuse 1986 6 p In DUTCH
(Rept-1014; ESA-86-96950) Avail: NTIS HC A02/MF A01

An 18 mm steel core cable of length 4 m and a minimal fracture strength of 217 kN was subjected to pulsating dynamic loads to test synthetic sockets. Using an 800 cc pulsator and a 40 ton universal test cylinder, pulsating pull loads with upper and lower limits of 51.5 and 6.5 kN were carried out. After 127,500 load variations (frequency 100 var/min) at 50 cm from the sockets, 7 fiber cracks are observed at the cylinder side; a 10.5 mm length increase is observed. After 268,680 variations values are 89 and 11.5 mm. The frequency was raised to 160 var/min giving a final crack after 452,830 variations; the last measured value of length is 16.5 mm. Tested sockets show good performance compared with other materials. ESA

N86-28480# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Lab. Soete for Strength of Materials and Welding T
REINFORCEMENT OF OPENINGS IN FLAT HEADS
Joris Decock Dec. 1985 54 p Sponsored by Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture
(CRIF-MT-164; ESA-86-97062) Avail: NTIS HC A04/MF A01

The results of a parametric study by the finite element method on flat heads with or without a central nozzle submitted to internal pressure and an axial nozzle load are presented. A design method which takes into account the stresses at different critical locations is derived. When obtained loadings are present the value of the maximum stresses can be derived. ESA

N86-28481# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Div. Avions.
STRESS INTENSITY FACTOR IN AN INTEGRAL OR BONDED STIFFENED PANEL USING AN ANALYTICAL METHOD
J. M. Thomas and B. Lachaud 1986 20 p In FRENCH; ENGLISH summary Presented at Colloq. sur les Tendances en Calcul de Struct., Bastia, France, 6-8 Nov. 1985 Submitted for publication
(SNIAS-861-111-104; ESA-86-97141) Avail: NTIS HC A02/MF A01

A mathematical model of a stiffened panel is described. The element is decomposed in a set of subelements for which analytical solutions exist. The results are then superposed respecting the compatibility constraints. The method leads to an economical computation technique to evaluate, for instance, damage tolerance. It is also shown that it could be used for fundamental parametric studies associated with the design of an aircraft. ESA

N86-28482# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Aircraft Div.
DESIGN OF BOLTED JOINTS IN CFRP STRUCTURES UNDER TENSION
Pierre Lafon 1986 7 p Presented at AGARD Struct. and Mater. Panel, Toulouse, 6 Sep. 1984
(SNIAS-861-111-112; ESA-86-97148) Avail: NTIS HC A02/MF A01

For the design of bolted joints in CFRP, it is shown that the empiric rule provides suitable results in most cases. In limited cases, when the empiric rule is inapplicable, local finite element analysis, which is longer and more expensive, is used. But the two methods are not fully satisfactory since they ignore parameters such as stacking sequence, bending of joint components, and bearing stress variation with thickness. ESA

N86-28483# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
CRITERIA FOR UNSTABLE CRACK EXTENSION UNDER DISPLACEMENT CONTROL
D. Munz and A. Brueckner Dec. 1985 43 p In GERMAN; ENGLISH summary
(KfF-4015; ISSN-0303-4003; ESA-86-96916) Avail: NTIS HC A03/MF A01

Criteria for the relation between compliance and crack size under displacement control were developed. Under displacement control, cracks in components usually extend first stably under decreasing load, and afterwards unstably. The critical load for the onset of unstable crack extension depends on the material, crack geometry, the component, and on the compliance of the loading system. The relation between compliance and crack size is worked out. The relations for linear-elastic fracture mechanics for flat and rising crack growth resistance curves, the plastic instability criterion, and the J-integral methods are discussed. ESA

N86-28484# Oak Ridge National Lab., Tenn.
ORVIRT.PC: A 2-D FINITE-ELEMENT FRACTURE ANALYSIS PROGRAM FOR A MICROCOMPUTER
J. W. Bryson Oct. 1985 55 p
(Contract NRC-FIN-B-0119; DE-AC05-84OR-21400)
(TI86-001867; NUREG/CR-4367; ORNL-6208) Avail: NTIS

HC A04/MF A01

The Oak Ridge virtual crack extension personal computer (ORVIRT.PC) is a two dimensional (2-D) finite-element fracture analysis program for an IBM PC/AT or PC/XT microcomputer. The code is based primarily on the techniques used in the ORMGENADINA-ORVIRT fracture analysis system. ORVIRT.PC is a stand-alone program capable of performing 2-D linear-elastic stress and fracture-mechanics analyses. Thermal loadings may be analyzed in addition to mechanical loadings. Crack-face tractions may also be considered. Eight-noded isoparametric elements that combine both performance and ease of modeling are employed in the program. Special crack-tip elements that allow for an inverse square root variation in the near tip stress and strain fields may be used at the crack tip. Detailed user instructions describe both preparation of input data and program operation. Sample problems are presented that demonstrate good agreement with known solutions. Author

N86-28485# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. National Engineering Lab.

STRUCTURAL DAMPING CALCULATIONS OF A LABORATORY PIPING SYSTEM USING MODAL ANALYSIS

J. G. Arendts and A. G. Ware 1986 7 p Presented at conference

(TI86-003223; EGG-M-09685; CONF-860224-6) Avail: NTIS HC A02/MF A01

The United States Nuclear Regulatory Commission and the Electric Power Research Institute have jointly sponsored construction of two laboratory piping systems for a variety of vibration research projects. EGSG Idaho used the responses of these systems to obtain piping system damping data considering different supports, methods of excitation, and calculational techniques. The 6-in., carbon steel systems were approximately fifty feet in length and were excited via impulse, simulated earthquake, and random and swept sine types of input motion. Data were reduced for the modes in the seismic range 0 to 33 Hz. The system damping deceased as response frequency increased and generally consistent values were computed from the different types of tests conducted. Author

N86-28486 United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.

THE INFLUENCE OF STRENGTH AND PHOSPHORUS SEGREGATION ON THE DUCTILE FRACTURE MECHANISM IN A Ni-Cr STEEL

C. A. Hippsley and S. G. Druce Oct. 1985 30 p

(AERE-R-11964) Copyright. Avail: Issuing Activity

Upper-shelf toughness and its degradation through ageing at 500 deg C have been investigated in quenched-and-tempered 300M steel as a function of tempering treatment at 650 deg C. Material having a 0 2% proof stress in the range 550 to 1000 MPa was examined. Toughness was assessed and was related to the ductile fracture mechanism through measurements of the strain required for void nucleation and void growth to coalescence. Changes in matrix rheology, void-nucleating precipitate morphology, bulk chemistry and interfacial chemistry were monitored during tempering and ageing, and the associated fractography was quantitatively assessed. The ductile fracture process in unaged material was dominated by the strain required for void nucleation on carbide precipitates. Nucleation strain increased with tempering time at 650 deg C causing a rise in ductility. Ageing at 500 deg C produced a loss of ductility for all temper conditions, and the sole cause of this effect was the segregation of phosphorus to carbide/matrix interfaces, identified by high resolution Auger spectroscopy. Both the strain required for void nucleation at carbides and that for void growth to coalescence were suppressed by ageing, through a reduction in interfacial cohesion consistent with the embrittling effect of segregated phosphorus. Author

N86-28487# Naval Academy, Annapolis, Md.

DEVELOPMENT AND VERIFICATION OF CONDITIONS FOR DUCTILE TEARING INSTABILITY AND ARREST

J. A. Joyce Feb. 1986 31 p

(Contract NRC-FIN-B7026)

(TI86-900891; NUREG/CR-4528) Avail: NTIS HC A03/MF A01

The objective of this work was to take an in-depth look at the process of ductile tearing instability and especially to evaluate experimentally the conditions for arrest of a ductile tearing instability. Major conclusions are that the ductile tearing instability initiates slowly, but in a mechanical spring apparatus it approaches drop tower crack growth rate conditions and hence the phenomena is effected by the material rate sensitivity. The conditions necessary for arrest are completely stated and demonstrated by experimental data on a 3 percent Ni structural steel. Author

42 GEOSCIENCES (GENERAL)

N86-28488# European Space Agency, Paris (France).

PROCEEDINGS OF A WORKSHOP ON THEMATIC APPLICATIONS OF SAR DATA

Duc Guyenne, comp. and Olga Melita, comp. Dec. 1985 106 p Workshop held in Frascati, Italy, 9-11 Sep. 1985

(ESA-SP-257; ISSN-0379-6566; ESA-86-96853) Avail: NTIS HC A06/MF A01

Applications of SAR data to agriculture, forestry, ice reporting, snow monitoring, and geological surveys were discussed. For individual titles, see N86-28489 through N86-28498. ESA

N86-28489# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

SELECTED APPROACHES TO THEMATIC SAR STUDIES c43

J. P. Guignard *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 5-6 (For primary document see N86-28488 19-42)

Avail: NTIS HC A06/MF A01

Studies aimed at establishing what SAR system parameters (e.g., frequency, angle of incidence, polarization) are most suited to thematic applications are introduced. Studies aimed at defining optimal information extraction schemes by assessing the statistical properties of required parameters and developing decision tools (e.g., Bayes estimators, maximum likelihood estimators) for automatic derivation of quantitative values related to geophysical phenomena, from SAR images are outlined. Studies of analysis tools of interest for any application, such as radargrammetry (correction of the geometry of the SAR images) and extraction of land features (e.g., roads, buildings) are discussed. ESA

N86-28490# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.

SAR FOR AGRICULTURE AND FORESTRY c43

S. Quegan, P. N. Churchill (Hunting Surveys Ltd., Boreham Wood, England), A. Wright, J. Lamont, A. J. Rye, and J. W. Trevett *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA Dec. 1985 p 7-14 (For primary document see N86-28488 19-42)

Avail: NTIS HC A06/MF A01

The data handling, system engineering and information extraction necessary for a land-use SAR are discussed. Data handling requires techniques for change detection and interpretation; in both areas present knowledge is inadequate. The lack of multitemporal SAR data and coordinated plant parameter data are a severe hindrance to the development of techniques and physical understanding. The present state of knowledge does not permit clear definition of the parameters for a land use SAR sensor, nor the requirement for ancillary data. Image interpretation is argued to be best carried out on a land-unit rather than pixel-by-pixel basis. Texture is shown to be a potential source of information independent of mean backscatter for land-cover. Human and machine measures of texture can be shown to correspond. ESA

N86-28491# National Aerospace Lab., Amsterdam (Netherlands).

USE OF A SAR IN AGRICULTURE AND FORESTRY c43

G. J. L. Nooren, J. C. A. vanderLubbe, E. P. W. Attema (Technische

Hogeschool, Delft, Netherlands), L. Krul, tj068073, and G. P. deLoor (Physics Lab. RVO-TNO, The Hague, Netherlands) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA Dec. 1985 p 15-20 (For primary document see N86-28488 19-42)
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A06/MF A01

Applications of SAR in agriculture and forestry were assessed, and classification and segmentation algorithms for SAR imagery were derived. Analysis suggests that for most of the applications, SAR imagery is inadequate. The segmentation algorithm is a bad estimator for field size, gives satisfactory results for field identification, and leads to accurate determination of field averaged pixel value. The performance improves when the number of looks is increased. The use of multitemporal data gives more improvement. The classifier is based on segments rather than pixels. For crop rotation detection, it gives a good result with a smaller training set than is usually required. The area determination is better than in the case of segmentation only. ESA

N86-28492# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SEA ICE PARAMETER RETRIEVAL FROM SAR DATA c48
H. Skriver and P. Gudmandsen *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 21-28 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

A pixel-by-pixel classification scheme for sea ice type determination, and a spatial segmentation scheme for studies of sea ice dynamics were investigated. Before these schemes may be applied, the inherent speckle must be reduced, and noncoherent averaging and adaptive filtering (Frost and Lee filters) were applied. The Lee filter seems to give the best results. The performance of the classification method is surprisingly good, with mean classification accuracies of 80%. Three segmentation algorithms were investigated: pyramid segmentation, edge-based segmentation, and region growing, with the second scheme considered to be the best. ESA

N86-28493# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
TOWARDS A SAR SYSTEM FOR SNOW AND LAND ICE APPLICATIONS c43
H. Rott, G. Domik (Vexcell Corp., Boulder, Colo.), C. Maetzler (Bern Univ. Switzerland), and H. Miller (Alfred-Wegener-Inst. for Polar Research, Bremerhaven, West Germany) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA Dec. 1985 p 29-39 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

The characteristics of a SAR system for snow and land ice monitoring and possible applications are considered. Characteristics of backscattering from snow and ice are discussed. Examples for radar image simulations which provide information on required antenna look angle and spatial resolution for snow cover monitoring are given. Preliminary specifications for a SAR system for snow and land ice monitoring are outlined. ESA

N86-28494# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE USE OF SAR SYSTEMS FOR GEOLOGICAL APPLICATIONS c46
F. Jaskolla (Ludwig-Maximilians-Universitaet, Munich, West Germany), M. Rast, and J. Bodechtel *In its* Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 41-50 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

Radar imagery was used for gelogical mapping in Southern Iceland, Bavaria, Italy, and Egypt. Radar data enables an improved identification of lithological units and structural features. Experiments on the information content of simultaneously collected X, C, and L-band data are needed. The application of radargrammetric correction is of great importance. ESA

N86-28495# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
LAND FEATURE EXTRACTION FROM SAR IMAGES c43
P. N. Churchill, S. Quegan (Marconi Co. Ltd., Chelmsford, England), N. Veck, and J. W. Trevett *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 51-55 Sponsored by ESA and British Government (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

The reliability and precision with which land features can be extracted from airborne and satellite borne SAR's are reviewed. The study demonstrates the benefits of combining optical with microwave sensors. The combination of different bands along the electromagnetic spectrum permits a greater depth of information to be analyzed. The combination of different ways of interacting with the vegetative canopy permits a wider analysis to be undertaken. Optical sensors tend to represent the reflection from the surface of the canopy, while active microwave sensors react with the structure of the canopy. ESA

N86-28496# Technische Univ., Graz (Austria). Inst. for Image Processing and Computer Graphics.
RADARGRAMMETRIC ASPECTS OF SAR DATA EVALUATION c32
J. Raggam, G. Triebnig, M. F. Buchroithner, G. Domik (Vexcell Corp., Boulder, Colo.), and F. W. Leberl *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 57-64 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

Radargrammetric image analysis is discussed, emphasizing applicability for geology and land snow and ice mapping. The results of these application studies lead to conclusions for radar satellite missions. A method to create digital elevation models from radar stereo-images is outlined. Radar stereo viewability is considered. ESA

N86-28497# Technische Univ., Graz (Austria). Inst. for Navigation.
SYNTHETIC APERTURE RADAR (SAR) PRODUCT SIMULATION c32
Ph. Hartl, A. Popella (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany), and A. J. Sieber *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 65-72 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

Existing SAR product simulator applicability to advanced land missions was assessed. It is found that none of them are appropriate. The requested input files characterizing the topography of an area of interest are not available to the quality necessary for realistic simulations. As part of the simulation itself, the modeling of image speckle and image texture and the coherent SAR data hologram need more research. The development of a coherent radar cross section data base, including coordinated monostatic and bistatic calibrated measurements; development of algorithms for modeling image speckle and image texture, and verification by analysis of existing SAR data; and harmonization of the development of digital terrain models are recommended. ESA

N86-28498# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
STUDY OF THE POTENTIAL OF SAR FOR CROP IDENTIFICATION AND MONITORING c43
Thuy LeToan, C. Kerr, H. Laur, A. Lopes, R. Touzi, A. K. Fung (Texas Univ., Arlington.), J. M. Durand (Centre National d'Etudes Spatiales, Toulouse, France), Y. Kerr, and J. Perbos *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 73-85 (For primary document see N86-28488 19-42)
(Contract ESA-6153/NL-MS)
Avail: NTIS HC A06/MF A01

It is shown that classification of vegetation covers with SAR data is possible using spectral and, to a lesser extent, textural

information. To fully demonstrate this potential for a wide range of crop and climatic conditions adapted SAR data sets must be available. They should be mainly multitemporal, multipolarisation (HH and VV) and/or multifrequency SAR images associated with detailed ground data. Progress in processing techniques must be made, in particular in filtering and segmentation methods. Extraction of vegetation parameters is possible. ESA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-28499*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SHUTTLE IMAGING RADAR VIEWS THE EARTH FROM CHALLENGER: THE SIR-B EXPERIMENT

J. P. Ford, J. B. Cimino, B. Holt, and M. R. Ruzek 15 Mar. 1986 146 p

(Contract NAS7-918)

(NASA-CR-177158; JPL-PUB-86-10; NAS 1.26:177158) Avail: NTIS HC A07/MF A01 CSCL 08B

In October 1984, SIR-B obtained digital image data of about 6.5 million km2 of the Earth's surface. The coverage is mostly of selected experimental test sites located between latitudes 60 deg north and 60 deg south. Programmed adjustments made to the look angle of the steerable radar antenna and to the flight attitude of the shuttle during the mission permitted collection of multiple-incidence-angle coverage or extended mapping coverage as required for the experiments. The SIR-B images included here are representative of the coverage obtained for scientific studies in geology, cartography, hydrology, vegetation cover, and oceanography. The relations between radar backscatter and incidence angle for discriminating various types of surfaces, and the use of multiple-incidence-angle SIR-B images for stereo measurement and viewing, are illustrated with examples. Interpretation of the images is facilitated by corresponding images or photographs obtained by different sensors or by sketch maps or diagrams. Author

N86-28500# Department of the Navy, Washington, D. C.

ENVIRONMENTAL MAPPING SYSTEM Patent

Ben H. Cantrell, inventor (to Navy) Issued 26 Nov. 1985 16 p Supersedes AD-D007413

(AD-D012146; US-Patent-4,555,703; US-Patent-Appl-SN-160877; US-Patent-Class-343-5SA) Avail: US Patent and Trademark Office CSCL 17/9

A circuit is described which detects environmental sources of echos received by a pulse-echo system such as radar and classifies the sources of the echo at each range resolution cell as either short pulse interference, ran clutter or jamming, distributed land clutter, an isolated target or thermal noise. The circuit implements on the screen of a cathode ray tube a digital map of a selected echo source type by modulating the electron beam intensity with a binary digit (o or 1) at each increment of the sweep corresponding to a range resolution cell. The circuit utilizes a pulse-to-pulse noncoherent subtraction to remove correlated echoes, leaving only uncorrelated type echos. Short pulse interference is then detected and the uncorrelated echo component is compared to thermal noise to determine if land clutter is determined from the uncorrelated echo component, and all correlated targets and land clutter and isolated targets by the following procedure: the isolated targets are required to have uncorrelated echoes on each side of them in range. Finally, if no detection of any of these types is made, thermal noise is declared. GRA

N86-28501# Consiglio Nazionale delle Ricerche, Rome (Italy). International Inst. for Geothermal Research.

CALCULATION OF GEOTHERMAL RESERVOIR TEMPERATURES AND STEAM FRACTIONS FROM GAS COMPOSITIONS

Franco DAmore and Alfred N. Truesdell (Geological Survey, Menlo Park, Calif.) 1985 7 p

(Contract DE-AI01-79RA-50294)

(DE86-005739; DOE/RA-50294/T2) Avail: NTIS HC A02/MF A01

The chemical equilibrium and physical characteristics of a fluid in a reservoir (temperature, steam fraction with respect to total water, gas/steam ratio, redox conditions), which seem to be responsible for the observed concentrations of some reactive species found in the geothermal fluids (CO2, H2, H2S, and CH4) are addressed. Gas geochemistry is of particular interest in vapor dominated fields where the fluid discharged consists of almost pure steam containing a limited number of volatile chemical species. Considering several geothermal systems, a good correlation was obtained among the temperatures calculated from the gas geothermometers and the temperatures measured in the reservoir or evaluated by other physical or chemical methods. Author

N86-28502# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.

STUDY ON USE AND CHARACTERISTICS OF SAR FOR LAND SNOW AND ICE APPLICATIONS Final Report

H. Rott, G. Domik, C. Maetzler, H. Miller, and K. G. Lenhart Paris ESA May 1985 164 p

(Contract ESA-5441/83-D-IM(SC))

(Rept-1(1985); ESA-CR(P)-2168; ESA-86-96867) Avail: NTIS HC A08/MF A01

Synthetic aperture radar systems for snow and land ice monitoring were investigated to define a land observation satellite mission. Applications and requirements for remote sensing of land cryosphere parameters are discussed. The physical background on scattering from snow and ice is discussed and results of backscattering measurements are compared with other investigations. Examples for spaceborne and airborne SAR data on snow and glaciers are provided and information for the interpretation of the radar image data is given. Synthetic radar images were generated for two test areas with different topography to define the optimum antenna look angle. Simulations based on real SAR data provided information on spatial resolution and signal to noise ratio. Promising applications and preliminary specifications for a SAR system on land cryosphere monitoring are presented. ESA

N86-28503# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

AEROSOL REMOTE SENSING USING THE MEASUREMENT OF THE STOKES VECTOR OF SCATTERED SOLAR RADIATION [AEROSOL-FERNSONDIERUNG MITTELS MESSUNG DES STOKES-VEKTORS GESTREUTER SOLARSTRAHLUNG]

Detlef Hennings, A. Ebel, ed., F. M. Neubauer, ed., E. Raschke, ed., and P. Speth, ed. 1985 89 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(Mitt-44; ISSN-0069-5882; ESA-86-96918) Avail: NTIS HC A05/MF A01

The optical characteristics of atmospheric aerosols were studied for application in passive remote sensing. Models and measured optical data were used. The effect of different aerosol scattering matrices on the solar radiation field was calculated using a radiation transfer code including reflection matrices of a rough water surface. Calculations indicate that the inverse of the degree of polarization as well as the radiance depend linearly on aerosol optical thickness, if observational conditions are properly selected, and that both measuring quantities are suited to measure optical thickness, due to their sensitivity. However, remote sensing of optical thickness by the components of the Stokes vector requires a more precise knowledge of the scattering matrices of atmospheric aerosols. Airborne measurements of the Stokes vector components were compared with model results; they agree within their measuring accuracy. ESA

N86-28504# Louisiana State Univ., Baton Rouge. Water Resources Research Inst.

DISCRETE KERNEL MODEL FOR SIMULATION OF MULTI-

LAYERED AQUIFERS
T. H. Illangasekare 1985 83 p Sponsored by Geological Survey (Grant DI-14-08-0001-G-909)
(PB86-170453; USGS/G-909-03) Avail: NTIS HC A05/MF A01 CSCL 08H

The design and development of a special management oriented groundwater model for the simulation of multilayered aquifers are presented. Multilayered aquifers consist of water bearing aquifer layers separated by permeable confining layers which permit significant leakage flow. The discrete kernel approach for groundwater modeling was used as the basic technique. The approach is based on the classical solution of partial differential equations using Green's function method. The three dimensional flow in the multilayered aquifer is simulated using a quasi-three dimensional flow model. The flow in each aquifer layer is modelled as two dimensional flow in the horizontal direction. The flow in the confining aquitard layers is assumed vertical. The model has the capability to compute the head with a higher resolution in any specified sub-regions of a large regional aquifer system. GRA

N86-28505# Louisiana State Univ., Baton Rouge. Water Resources Research Inst.
APPLICATION OF THE PRINCIPLE OF MAXIMUM ENTROPY (POME) TO HYDROLOGIC FREQUENCY ANALYSIS
V. P. Singh, K. Singh, and A. K. Rajagopal 1985 155 p Sponsored by Geological Survey
(Grant DI-14-08-0001-G-909)
(PB86-170420; USGS/G-909-05) Avail: NTIS HC A08/MF A01 CSCL 08H

The principle of maximum entropy (POME) was employed to develop a procedure for deviation of a number of frequency distributions used in hydrology for performing flood frequency and risk analysis. The procedure required specification of constraints and maximization of entropy, and was thus a solution of the classical optimization problem. Data on four rainfall-runoff events from a large outdood rainfall-runoff experimental facility were used for fitting the IUH by five different methods. For six selected river gaging stations, parameters of the gamma distribution, fitted to annual maximum discharges, were evaluated by POME and compared with those obtained by using the methods of moments (MOM) and maximum likelihood estimation. GRA

N86-28506# Mississippi State Univ., Mississippi State. Center for Computational Hydroscience and Engineer
MATHEMATICAL MODELS OF SEDIMENT EFFECTS ON WATER RESOURCES SYSTEMS Interim Report
S. S. Y. Wang Sep. 1985 36 p Sponsored by Geological Survey
(PB86-164241; USGS/G-915-05) Avail: NTIS HC A03/MF A01 CSCL 08H

Sediment is not only a major water pollutant itself but also a carrier and storage agent of other pollution. The project studied its effects on water resources by the application of the most cost-effective research methodology, numerical-empirical modeling. The most recently developed computational techniques were integrated with the most reliable empirical functions so that the complex sediment transport phenomena can be simulated on digital computers. It can be used both in hydraulic engineering project designs and in environmental engineering impact studies, especially the long-term environmental impact prediction. GRA

N86-28507# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
COASTAL: A DISTRIBUTED HYDROLOGIC SIMULATION MODEL FOR LOWER COASTAL PLAIN WATERSHEDS IN GEORGIA
C. H. Sun and G. A. Brook Aug. 1985 110 p Sponsored by Geological Survey Prepared in cooperation with Georgia Univ., Athens
(Grant DI-14-08-0001-G-900)
(PB86-164209; ERC-06-85; USGS/G-900-03) Avail: NTIS HC A06/MF A01 CSCL 08H

Overland flow to streams is rare in the Lower Coastal Plain watersheds of Georgia. As a result, commonly-used watershed hydrologic simulation models can not be used to predict streamflow accurately. Therefore, a distributed watershed hydrologic simulation model, named COASTAL, has been developed specifically for the Lower Coastal Plain regions of Georgia, Florida, and South Carolina. A basic assumption of the model, which can be run on a personal computer, is that all streamflow results from ground water discharge into stream channels. COASTAL was developed by combining surface and ground water simulation models. GRA

N86-28508# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
SIMPLIFIED APPROACH TO REGIONAL MULTILAYERED AQUIFER ANALYSIS
M. M. Aral Aug. 1985 77 p Sponsored by Geological Survey (Grant DI-14-08-0001-G-900)
(PB86-164167; USGS/G-900-02) Avail: NTIS HC A05/MF A01 CSCL 08H

In order to effectively monitor and manage aquifers subjected to artificial recharge as well as increased pumping demands, it is necessary to analyze their hydrodynamic response. Several mathematical numerical models were developed to accomplish this purpose on regional scale for single layer aquifiers. A regional two-dimensional flow analysis was formulated using finite element techniques for multilayer aquifiers. The advantages of using finite element analysis for aquifer analysis become evident when attempting to model irregular boundaries and variable inputs such as recharge, pumping and field properties in multilayer systems. GRA

N86-28509# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems.
FLECHT SEASET PROGRAM Final Report
L. E. Hochreiter Nov. 1985 351 p Sponsored by EPRI
(Contract NRC-FIN-B-6204; EPRI Proj. 959-1)
(TI86-900422; NUREG/CR-4167; EPRI-NP-4112; WCAP-10926; NRC/EPRI/WESTINGHOUSE-16) Avail: NTIS HC A16/MF A01

The highlights and main findings of the United States Nuclear Regulatory Commission (USNRC), the Electric Power Research Inst., Westinghouse cooperative full-length emergency cooling heat transfer seperate effects and systems effects tests (FLECHT SEASET) program are given. Areas in which the results of the program can contribute to revising the current licensing requirements for Loss of Coolant (LOCA) safety analysis for water cooled reactors are indicated. Also identified are several technical areas in which the new FLECHT SEASET data and analysis can lead to improved safety analysis modeling, and thereby to predicted pressurized water reactor (PWR) response for postulated accident scenarios. Significant progress has been made in the modeling areas of nonequlibrium dispersed two-phase flow during reflood. Improved models and understanding of this rod bundle cooling regime are summarized in this report. Another important result of the FLECHT SEASET program arises from the natural circulation test series, which investigated single-phase, two-phase, and reflux condensation cooling modes of a scaled PWR under small-break LOCA conditions. The tests and subsequent analysis consitute one of few complete sets of data for these cooling modes in which full-height, multitube steam generators with sufficient instrumentation were used to examine primary-to-secondary heat transfer in the generators. It is believed that the natural circulation test data will be extremely useful to benchmark the improved post-TMI small-break LOCA computer codes. Author

N86-28294*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MARCH 1985 DEMONSTRATION OF THE FIDUCIAL NETWORK CONCEPT FOR GPS GEODESY: A PRELIMINARY REPORT
J. M. Davidson, C. L. Thornton, T. H. Dixon, C. J. Vegos, L. E. Young, and T. P. Yunck *In its* The Telecommunications and Data Acquisition Report 15 May 1986 7 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 08E

N86-28424*# Naples Univ. (Italy). Inst. of Gasdynamics.
HIGH RESOLUTION REMOTE SENSING MISSIONS OF A TETHERED SATELLITE
Sergio Vetrella and A. Moccia *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 349-363 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28489# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SELECTED APPROACHES TO THEMATIC SAR STUDIES
J. P. Guignard *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 5-6 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

N86-28490# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.
SAR FOR AGRICULTURE AND FORESTRY
S. Quegan, P. N. Churchill (Hunting Surveys Ltd., Boreham Wood, England), A. Wright, J. Lamont, A. J. Rye, and J. W. Trevett *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA Dec. 1985 p 7-14 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

N86-28491# National Aerospace Lab., Amsterdam (Netherlands).
USE OF A SAR IN AGRICULTURE AND FORESTRY
G. J. L. Nooren, J. C. A. vanderLubbe, E. P. W. Attema (Technische Hogeschool, Delft, Netherlands), L. Krul, tj068073, and G. P. deLoor (Physics Lab. RVO-TNO, The Hague, Netherlands) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA Dec. 1985 p 15-20 (For primary document see N86-28488 19-42)
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A06/MF A01

N86-28493# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
TOWARDS A SAR SYSTEM FOR SNOW AND LAND ICE APPLICATIONS
H. Rott, G. Domik (Vexcell Corp., Boulder, Colo.), C. Maetzler (Bern Univ. Switzerland), and H. Miller (Alfred-Wegener-Inst. for Polar Research, Bremerhaven, West Germany) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA Dec. 1985 p 29-39 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

N86-28495# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
LAND FEATURE EXTRACTION FROM SAR IMAGES
P. N. Churchill, S. Quegan (Marconi Co. Ltd., Chelmsford, England), N. Veck, and J. W. Trevett *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 51-55 Sponsored by ESA and British Government (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

N86-28498# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
STUDY OF THE POTENTIAL OF SAR FOR CROP IDENTIFICATION AND MONITORING
Thuy LeToan, C. Kerr, H. Laur, A. Lopes, R. Touzi, A. K. Fung (Texas Univ., Arlington.), J. M. Durand (Centre National d'Etudes Spatiales, Toulouse, France), Y. Kerr, and J. Perbos *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 73-85 (For primary document see N86-28488 19-42)
(Contract ESA-6153/NL-MS)
Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-28510 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, s'Gravenhage (Netherlands). Hoofdgroep Maatschappelijke Technologie.
DESIGN CRITERIA FOR SMALL WIND TURBINES. PART 2: WIND CHARACTERIZING
G. L. H. Beugeling and P. E. J. Vermeulen Aug. 1985 126 p In DUTCH Sponsored by NLR and Stichting Projectbeheerbureau Energie Onderzoek
(Rept-85-010880-Pt-2; MT-TNO-8724-11344; ESA-86-97015) Copyright. Avail: Issuing Activity

A calculation model to determine turbulent wind velocity and Wind Direction Fluctuations (WDFs) on a rotating wind turbine rotor was developed to draw up simply applicable and rotor type differentiated design criteria. Using statistical methods, fatiguing and extreme wind gusts as well as turbulent WDFs were constructed and determined as dependent upon criteria chosen (exceed chances). Interstationary (mesoscale) WDFs expected were estimated using literature about squalls and front systems. A second model to determine wind shear for fatigue calculation was also developed. Design gusts (for different classes of hourly average wind velocity at axis height) turbulent WDFs, and wind shear are given for a small wind turbine. ESA

N86-28511*# Toledo Univ., Ohio.
APPLICATION OF A PERSONAL COMPUTER FOR THE UNCOUPLED VIBRATION ANALYSIS OF WIND TURBINE BLADE AND COUNTERWEIGHT ASSEMBLIES Final Report
Phillip R. White and Ronald R. Little Dec. 1985 144 p
(Contracts NCC3-5; DE-AI01-76ET-20320)
(NASA-CR-175090; DOE/NASA/0005-3; NAS 1.26:175090) Avail: NTIS HC A07/MF A01 CSCL 10A

A research effort was undertaken to develop personal computer based software for vibrational analysis. The software was developed to analytically determine the natural frequencies and mode shapes for the uncoupled lateral vibrations of the blade and counterweight assemblies used in a single bladed wind turbine. The uncoupled vibration analysis was performed in both the flapwise and chordwise directions for static rotor conditions. The effects of rotation on the uncoupled flapwise vibration of the blade and counterweight assemblies were evaluated for various rotor speeds up to 90 rpm. The theory, used in the vibration analysis codes, is based on a lumped mass formulation for the blade and counterweight assemblies. The codes are general so that other designs can be readily analyzed. The input for the codes is generally interactive to facilitate usage. The output of the codes is both tabular and graphical. Listings of the codes are provided. Predicted natural frequencies of the first several modes show reasonable agreement with experimental results. The analysis codes were originally developed on a DEC PDP 11/34 minicomputer and then downloaded and modified to run on an ITT XTRA personal computer. Studies conducted to evaluate the efficiency of running the programs on a personal computer as compared with the minicomputer indicated that, with the proper combination of hardware and software options, the efficiency of using a personal computer exceeds that of a minicomputer. Author

N86-28512*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOLAR STIRLING RECEIVER ALTERNATIVES FOR THE TERRESTRIAL SOLAR APPLICATION

J. Stearns 30 Apr. 1986 36 p
(Contract NAS7-918; JPL Proj. 5105-165; Contract DE-AM04-80AL-13137)
(NASA-CR-177155; JPL-PUB-86-13; DOE/JPL-1060-96; NAS 1.26:177155) Avail: NTIS HC A03/MF A01 CSCL 10A

Concept studies have been completed for four dish-Stirling receivers, i.e., solar only and thermal storage receiver, each of which is either directly coupled or indirectly (heat pipe) coupled to the Stirling engine. The results of these studies are to be applied to systems benefit/cost analysis to determine the most desirable development approach. Author

N86-28513# Eagle-Picher Industries, Inc., Joplin, Mo. Electronics Div.
CALCIUM/THIONYL CHLORIDE BATTERY TECHNOLOGY Final Report, Feb. 1982 - Jun. 1985
T. Counts Dec. 1985 359 p
(Contract F33615-81-C-2076)
(AD-A165657; AFWAL-TR-85-2081) Avail: NTIS HC A16/MF A01 CSCL 10/3

This final report documents the development efforts conducted by the Lithium Batteries Group of the Couples Department of Eagle-Picher Industries. The objective of the project was to develop calcium-thionyl chloride cell technology. The original project was divided into two main tasks. Task One was to consist of component optimization and stability studies. Once sufficiently advanced, the ongoing results of Task One were to be integrated with Task Two. Task Two was to consist of demonstration of an optimized primary cell. In July, 1983, the program was redirected. Task Two was split, with effort to be directed toward both the original primary cell and toward a high discharge rate reserve configuration cell. Additional electrolyte salts were to be evaluated as a means of improving the storability of the active calcium-thionyl chloride cell. GRA

N86-28514# Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPUTER PROGRAM TO SIMULATE THE THERMAL CHARACTERISTICS OF HEAT RECOVERY INCINERATORS Final Report, Oct. 1981 - Sep. 1984
C. A. Kodres Feb. 1986 119 p
(AD-A165672; NCEL-1745) Avail: NTIS HC A06/MF A01 CSCL 13/1

The computer program, HRI, is described. This model simulates the thermal characteristics of energy (heat) recovery incinerators. The program takes descriptions of the fuel and of the incinerator as inputs then predicts system temperatures, steam generation rate, and energy recovery efficiency. There are options to include primary or secondary waterwalls, a water/firetube boiler, or combinations of these heat exchangers. Both starved and excess air operations are considered. Author (GRA)

N86-28515# New Energy Development Organization, Tokyo (Japan).
RESEARCH AND DEVELOPMENT OF FUEL CELL GENERATION TECHNOLOGY Annual Report, FY 1984
Apr. 1985 33 p
(DE86-900205; NP-6900205) Avail: NTIS (US Sales Only) HC A03/MF A01

Low-temperature, low-pressure phosporic-acid fuel-cell power generation systems are being developed, as are matrix and paste electrolyte type molten-carbonate fuel-cell pilots plants. System analyses are also reported. DOE

N86-28516# Bechtel Corp., San Francisco, Calif.
FEASIBLE UTILITY SCALE SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEM
R. J. Loyd, S. M. Schoenung, T. Nakamura, D. W. Lieurance, M. A. Hilal, J. D. Rogers, J. R. Purcell, and W. V. Hassenzahl 1986 7 p Presented at the IEEE Power Engineering Society Winter Meeting, New York, N.Y., 2 Feb. 1986 Prepared in cooperation with General Dynamics Corp., San Diego, Calif., Los Alamos National Lab., N. Mex., GA Technologies, Inc., San Diego, Calif. and California Univ., Berkeley, Lawrence Berkeley Lab.
(Contract W-7405-eng-36)
(DE86-000812; LA-UR-85-3342; CONF-860210-1) Avail: NTIS HC A02/MF A01

This paper presents the latest design features and estimated costs of a 5000 MWh/1000 MW Superconducting Magnetic Energy Storage (SMES) plant. SMES is proposed as a commercially viable technology for electric utility load leveling. The primary advantage of SMES over other electrical energy storage technologies is its high net roundtrip efficiency. Other features include rapid availability and low maintenance and operating costs. Economic comparisons are made with other energy storage options and with gas turbines. In a diurnal load leveling application, a superconducting coil can be charged from the utility grid during off-peak hours. The ac grid is connected to the dc magnetic coil through a power conversion system that includes an inverter/rectifier. Once charged, the superconducting coil conducts current, which supports an electromagnetic field, with virtually no losses. During hours of peak load, the stored energy is discharged to the grid by reversing the charging process. The principle of operation of a SMES unit is shown. For operation in the superconducting mode, the coil is maintained at extremely low temperature by immersion in a bath of liquid helium. DOE

N86-28517# Pacific Northwest Lab., Richland, Wash.
ENERGY STORAGE TECHNICAL AND ECONOMIC ANALYSIS PROGRAM Annual Report
Nov. 1985 32 p
(Contract DE-AC06-76RL-01830)
(DE86-004182; PNL-5678) Avail: NTIS HC A03/MF A01

The DOE Energy Storage program over the last several years has evaluated a large number of energy storage technologies, developed promising technologies, and successfully transferred new technologies to the private sector. In FY-1985 specific tasks involved in this area included: battery systems requirements analysis, statistical analysis of battery failures, and research needs for corrosion control and prevention in energy conservation systems. Battery cost analysis, R and D planning, and technology transfer/market analysis are also reported. DOE

N86-28518# Pacific Northwest Lab., Richland, Wash.
CALCULATION OF WAKE POWER LOSSES IN A TWO-LEVEL ARRAY: A SIMPLE CASE STUDY
J. C. Barnard Dec. 1985 20 p
(Contract DE-AC06-76RL-01830)
(DE86-005671; PNL-5721) Avail: NTIS HC A02/MF A01

One method of adding capacity is to install another array of turbines whose hub height is above the existing array. This report estimates the wake interference that could be expected in a two-level array. Interference is estimated for a typical situation that may be encountered by a wind farm developer. A modified Lissaman array model is used to make the wake interference calculations. The model calculations show that the wake interference between the two levels is small for the turbine characteristics and turbine layouts considered. (The windwise spacings are about 5.4 and 10.8D for the lower and upper levels of turbines, respectively.) Power losses are about 5% or less at rated speed. Thus, two-level arrays may be a viable way of increasing the generating capacity of existing wind farms. DOE

N86-28519# Varigas Research, Inc., Timonium, Md.
COMPRESSED AIR SYSTEMS: A GUIDEBOOK ON ENERGY AND COST SAVINGS
E. M. Talbott 1986 197 p
(DE86-005723; DOE/NBM-6005723) Avail: NTIS HC A09/MF A01

This guidebook seeks to increase the awareness of the compressed air equipment designers, system engineers and air users to the opportunities for conserving energy. By suggesting methodology and offering approaches to energy and cost analysis, it is expected to motivate conservation through better system design and management. It has been the intention that the book be factual and understandable to working level engineers and supervisors, and that the results be seen on the factory floor.

Therefore, a style somewhat less formal than that of the most technical reports has been adopted. Significant data and methodology are still covered. DOE

N86-28520# Advanced Mechanical Technology, Inc., Newton, Mass.
ANALYTICAL STUDY OF LIQUID-PISTON HEAT PUMP TECHNOLOGY
J. Gerstmann and K. Hules Dec. 1985 122 p
(Contract W-31-109-eng-38)
(DE86-005755; ANL-CT-85-2) Avail: NTIS HC A06/MF A01

While the evaluation of the feasibility of the liquid-piston heat pump (LPHP) concept is not yet complete, several preliminary conclusions may be stated based upon the initial results: (1) Simulation of an isothermal LPHP using the second order computer model indicates that the LPHP can self-start and achieve stable oscillations. (2) Examination of the principal loss mechanisms has identified no losses that are peculiar to the LPHP, and indicates that the magnitudes of the losses are similar to those of conventional Stirling engines and heat pumps. (3) The cooling COP of an LPHP operated from a 400C heat source is estimated to lie between 0.3 for an adiabatic high pressure-ratio heat pump, up to about 1.2 for an isothermal heat pump or an adiabatic, low pressure-ratio heat pump. (4) Examination of liquid piston frictional effects and other practical considerations suggest that it will not be feasible to achieve isothermal expansion/compression in practice. Therefore, prediction of LPHP performance should be based on an adiabatic model. (5) Although a true optimization has not yet been performed, preliminary indications are that the favorable operating frequency of an LPHP will be in the range of 1 to 10 Hz. In order to achieve high specific power (e.g., of the order of 10 kW/liter of displacement), a mean pressure of the order of 7 MPa (1000 psia) is required. (6) Taylor instability of the liquid piston interface will occur at all frequencies of interest unless some means of stabilizing the interface is employed. DOE

N86-28521# Sandia National Labs., Albuquerque, N. Mex.
BATTERIES IN ELECTRIC VEHICLE AND SOLAR CONVERSION APPLICATIONS
K. D. Murphy and R. P. Clark 1986 14 p Presented at the Conference on Applications and Advances in Battery Technology, Long Beach, Calif., 14 Jan. 1986
(Contract DE-AC04-76DP-00789)
(DE86-005887; SAND-85-2565C; CONF-860112-1) Avail: NTIS HC A02/MF A01

This paper reviews sodium-sulfur, zinc-bromine, sealed lead-acid, hydrogen-nickel oxide, and other advanced battery systems. At this time, there is not a clear winner in the race for the ultimate battery. Each system demonstrates particular advantages, such as performance, cost, or durability, but these are often offset by weaknesses that require focused developmental efforts. However, based on projected characteristics, several advanced batteries have great promise for satisfying future energy storage needs. DOE

N86-28522# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik.
HEAT PUMP WITH EXTERNAL COMBUSTION Final Report, Sep. 1984
Bernhard Bauer and Anton Mantel Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 88 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-142; ISSN-0340-7608; ESA-86-96895) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.50

A heat pump unit, in which the pump cycle and a Clausius-Rankine vapor power unit are connected by a common condenser and a Combined Expansion-Compression Machine (CECM) with heat as propulsive energy is discussed. A CECM according to the Free Piston (FP) principle, with air as the working fluid, was developed. The FP machine was tested. A CECM according to the FP principle, with R 114 as the working fluid, was constructed. A heat pump test facility was designed and built. A test rig to show the thermal stability of refrigerants was developed. ESA

N86-28523# Netherlands Energy Research Foundation, Petten.
LOAD FLUCTUATIONS AND RESPONSE OF ROTOR SYSTEMS IN TURBULENT WIND FIELDS
J. B. Dragt Oct. 1985 33 p Presented at Windpower Conf., San Francisco, Calif., Aug. 1985
(ECN-172; B8577047; ESA-86-97019) Avail: NTIS HC A03/MF A01

A frequency domain model was developed to take time and space dependence of incoming wind turbulence into account, to determine the apparent wind speed fluctuations for a rotating wind turbine blade, and the consequent load fluctuations. Wind speed and load fluctuations are described in frequency spectra, expanded in rotational modes centered around the harmonics of the rotation frequency. Similar expansions apply to flexible rotor systems, where frequency filters appear due to flapping blade motions. This is demonstrated for a hinged blade rotor. The filters are characterized by physical blade parameters like mechanical, centrifugal and aerodynamic stiffness, and aerodynamic damping. Calculated spectra, and fatigue damage rate estimations are presented. Applications and limitations of the model are discussed. ESA

N86-28524# Netherlands Energy Research Foundation, Petten. Bureau Energie Onderzoek Projecten.
INTEGRAL TIP VANE DEVELOPMENT PROGRAM: PROPOSAL FOR THE FIRST PART [INTEGRAAL TIPVANE ONTWIKKELINGSPROGRAMMA: VOORSTEL VOOR HET EERSTE DEEL]
Apr. 1984 40 p In DUTCH Prepared in cooperation with Technische Hogeschool, Delft, NLR, and Energieonderzoek Centrum Nederland
(BEOP-CR-9; ESA-86-96958) Avail: NTIS HC A03/MF A01

The development, construction, and testing of a high speed 25 m diameter tip vane rotor to prove the feasibility of a high speed concept (the low speed concept shows good performance), and to carry out preliminary studies on behalf of optimization and upscaling is proposed. Financial/organizational aspects and the distribution of the activities per project-participant are elucidated. ESA

N86-28525# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
WINDPOWERED STATION WITH VARIABLE SPEED: A PRELIMINARY SPEED
Eskil Ulen Nov. 1985 127 p In SWEDISH; ENGLISH summary (FOA-C-20591-E3; ISSN-0347-3694; ESA-86-97033) Avail: NTIS HC A07/MF A01

Control problems when changing to variable speed are discussed for the series version of WTS-3 units. This study can be used for planning, development, analysis, and simulation. A simplified blade control in combination with electric control of the generator is assumed. Detailed study of this electric control is emphasized, while the total system is more superficially treated. Simulation facilities are mentioned. ESA

N86-28526# EG and G Washington Analytical Services Center, Inc., Berkeley, Calif.
OTEC (OCEAN THERMAL ENERGY CONVERSION) COLD WATER PIPE AT-SEA TEST PROGRAM DATA ANALYSIS PROJECT: PIPE, PLATFORM AND ENVIRONMENTAL PARAMETERS DATA REDUCTION AND ANALYSIS
L. A. Vega and G. C. Nilhous Aug. 1985 152 p Sponsored by National Ocean Service
(Contract DGNC-5-00093)
(PB86-177607) Avail: NTIS HC A08/MF A01 CSCL 10B

An assessment of computer models developed to analyze the structural response of cold water pipes (CWPs) is discussed. The principal aim of the data interpretation phase of the study was to determine the causal relationship between the environment and the barge/CWP response to provide the information required to assess the CWP computer models. GRA

N86-28527# EG and G Washington Analytical Services Center, Inc., Berkeley, Calif.
OTEC (OCEAN THERMAL ENERGY CONVERSION) COLD WATER PIPE AT-SEA TEST PROGRAM DATA ANALYSIS PROJECT: USERS GUIDE FOR THE NOAA/ROTECF AND NOAA/TRW COMPUTER MODELS
L. A. Vega and G. C. Nihous Jun. 1985 152 p Sponsored by National Ocean Service
(Contract DGNC-5-00093)
(PB86-177615) Avail: NTIS HC A08/MF A01 CSCL 10B

Additional guidelines for the use of the Cold-Water-Pipe computer models NOAA/TRW and NOAA/ROTECF are provided. The primary intent is to correct and upgrade the user manuals with errata sheets and to provide an updated listing of the source codes. It is recommended that users be familiar with the hydrodynamic and structural aspects of floating vessels and the representation of ocean thermal energy conversion pipes as beams of equivalent structural properties. GRA

N86-28528# Institute of Gas Technology, Chicago, Ill.
MOLTEN CARBONATE FUEL CELL STACK DESIGN OPTIONS
Thomas G. Benjamin and Randy J. Petri 1986 12 p Presented at the 13th Energy Technology Conference and Exposition, Washington, D.C., 17-19 Mar. 1986
(TI86-900893; CONF-860303-4) Avail: NTIS HC A02/MF A01

Significant strides in molten carbonate fuel cell (MCFC) life and performance were made duing the last 20 years. Results include single cell performance improvement from 10 watts/sq ft to 120 watts/sq ft, testing of several subscale stacks, and significant reductions in cost. In the 1980s, attention has turned toward stack related issues including component dimensional and structural stability, cathode dissolution, sulfur poisoning, hardware design, electrolyte management, carbon dioxide conservation, internal reforming, and systems considerations. The MCFC stack hardware design options are discussed and a brief introduction to MCFC technology is presented. Author

N86-28529*# Purdue Univ., West Lafayette, Ind.
INK JET PRINTING OF SILVER METALLIZATION FOR PHOTOVOLTAICS Quarterly Technical Report, Jul. 1 - 30 Sep. 1985
R. W. Vest 21 Oct. 1985 34 p
(Contracts NAS7-100; JPL-957031)
(NASA-CR-177190; DOE/JPL-957031/85/4; NAS 1.26:177190; DE86-002807) Avail: NTIS HC A03/MF A01

Work performed on the development of ink jet printing of silver metallization for solar cells concentrated primarily on evaluating the effects of various cell processing techniques and on ink studies. Studies were done to determine how cleaning the cells in a dilute HF solution (or not cleaning them) might be affecting the cell's series resistance. A standardized test procedure was developed to obtain I-V curves for the cells. A method of edge grinding the cells was developed in order to minimize shunt conductance. An attempt was made to find an additive that would change the surface tension of inks without significantly altering the viscosity. Studies in the use of a 0.5 mil hole in the print head array plate were done. New power supplies were installed on a temporary basis. Computer aided design capabilities will, when implemented, allow for rapid transitions from conceptual designs on the computer to actual printing with the ink jet system. DOE

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-28530# Texas A&M Univ., College Station. Dept. of Oceanography.
GEOLOGICAL AND GEOCHEMICAL IMPLICATIONS OF GAS HYDRATES IN THE GULF OF MEXICO Final Report
J. M. Brooks and W. R. Bryant Sep. 1985 137 p
(Contract DE-FG21-84MC-21088)
(DE86-001011; DOE/MC-21088/1964) Avail: NTIS HC A07/MF A01

This document presents the results of a study of the geological and geochemical implications of gas hydrates in the Gulf of Mexico. The report is based primarily on data obtained from available seismic surveys of the Green Canyon, Garden Banks, Mississippi Canyon, and Orca Basins areas of the northern continental margin of the Gulf of Mexico. The study also includes the data and analysis obtained from several gas hydrate cores recovered in these areas. The report provides new data relevant to gas hydrate research for more in-depth research of the Gulf of Mexico gas hydrates and provides significant information which advances the knowledge and understanding of gas hydrate formations in the natural environment. The report contains several high resolution seismic surveys. In the four hydrate sites studied in detail, the seismic wipeout zones were all associated with collapsed structures, fault scarps, and/or salt piercement structures. These features provide conduits for the upward migration of either biogenic or thermogenic gas from depth. DOE

N86-28531# Mitre Corp., McLean, Va.
ACID DEPOSITION
J. Chamberlain, H. Foley, D. Hammer, G. MacDonald, S. Matarazza, O. Rothaus, and M. Ruderman Jul. 1985 100 p
(Contract DE-AC01-82ER-30029)
(DE86-001596; DOE/ER-30029/T2) Avail: NTIS HC A25/MF A01

Presented is an overview of the acid rain phenomena with unanswered questions and research recommendations. Arguments to support the following hypothesis are offered: In the northeastern United States (unlike in western and central Europe) during the winter half of the year and perhaps even during summer, the total amount of SO2 converted to sulfate and then deposited as sulfuric acid in rain may be determined more by the availability of oxidants than by the amount of SO2 emitted. When, and if, the availability of oxidants limits SO2 oxidation, any reduction of SO2 emissions would not lead to a proportional reduction in the amount of sulfuric acid deposited by wet precipitation. Although the amount of sulfuric acid in rain is widely measured, its probable dependence on oxidants makes it an unsuitable indicator of the presently unmeasured total deposition of sulfates and sulfuric acid precursors. A possible oxidant limitation to sulfuric acid in rain and snow may be much less important when considering total sulfur deposition; this includes dry deposition, which may be larger in magnitude and no less environmentally important than wet acid precipitation. One might expect there to be the so-called linearity between total SO2 emissions and sulfur deposition only when considering the total acid deposition due to SO2 emissions. DOE

N86-28532# Stockholm Univ. (Sweden). Dept. of Meteorology.
NITRATE IN PRECIPITATION: A PRESENTATION OF DATA FROM THE EUROPEAN AIR CHEMISTRY NETWORK (EACN)
Rolf Soederlund, Lennart Granat, and Henning Rodhe 26 Sep. 1985 72 p
(Grants G-GU-3922-105; SWED-EPB-641-3308-82-Fp)
(CM-69; ISSN-0280-445X; ESA-86-97057) Avail: NTIS HC A04/MF A01

Data on the nitrate content of monthly precipitation samples during the period 1955 to 1979 are presented. Employing a median two-way table statistical analysis a seasonal variation of the nitrate concentration with high concentration in January through April and low concentration in June through October is found. All stations but one exhibit an increase in concentration during the period. The annual increase in nitrate concentration between the late 1950's and early 1970's is in the range 3% to 6% at 75% of the stations. Sampling artifacts caused by microbiological transformations in the sampled water after collection may have a certain, probably not substantial, influence on results. ESA

N86-28533# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
ACID RAIN: FEDERAL RESEARCH INTO EFFECTS ON WATERS AND FORESTS

Dec. 1985 56 p
(PB86-170685; GAORCED-86-7; B-220896) Avail: NTIS HC A04/MF A01 CSCL 08H

The status and future direction of the national Acid Precipitation Assessment Program's research to determine acid deposition's effects on our lakes, streams, and forests are given. Information on the funding supporting the national program's research effort is provided. GRA

N86-28870# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Chimie 1.
HOT ATOM CHEMISTRY AND RADIOLYSIS OF GASEOUS AND SOLID COMPONENTS OF PLANETARY ATMOSPHERES
K. Roessler *In* ESA The aTmospheres of Saturn and Titan Dec. 1985 p 175-188 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-28534*# Texas Univ., Austin. Center for Space Research.
SIMULATION AND ANALYSIS OF A GEOPOTENTIAL RESEARCH MISSION Semiannual Status Report
B. E. Schutz Jun. 1986 37 p
(Grant NAG5-528)
(NASA-CR-176789; NAS 1.26:176789) Avail: NTIS HC A03/MF A01 CSCL 08N

A computer simulation was performed for a Geopotential Research Mission (GRM) to enable study of the gravitational sensitivity of the range/rate measurement between two satellites and to provide a set of simulated measurements to assist in the evaluation of techniques developed for the determination of the gravity field. The simulation, identified as SGRM 8511, was conducted with two satellites in near circular, frozen orbits at 160 km altitude and separated by 300 km. High precision numerical integration of the polar orbits was used with a gravitational field complete to degree and order 180 coefficients and to degree 300 in orders 0 to 10. The set of simulated data for a mission duration of about 32 days was generated on a Cray X-MP computer. The characteristics of the simulation and the nature of the results are described. Author

N86-28535*# Lunar and Planetary Inst., Houston, Tex.
WORKSHOP ON EARLY CRUSTAL GENESIS: THE WORLD'S OLDEST ROCKS
L. D. Ashwal, ed. 1986 187 p Workshop held in Godthab, Greenland, 21-30 Jul. 1985; sponsored by NASA, LPI, NSF, Gronlands Geologiske Undersogelse and the Commission for Scientific Research in Greenland
(Contract NASw-4066)
(NASA-CR-177306; NAS 1.26:177306; LPI-TR-86-04) Avail: NTIS HC A09/MF A01 CSCL 08G

Topics addressed include: a general review of Precambrain crustal evolution; geology and geochemistry of the Archean Craton in Greenland and Labrador; Precambrian crustal evolution in North and South America; and the field excursion to the Ameralik Fjord. For individual titles, see N86-28536 through N86-28560.

N86-28536*# Lunar and Planetary Inst., Houston, Tex.
SPECULATIONS ON NATURE AND EXTENT OF ARCHEAN BASEMENT IN LABRADOR AS INDICATED BY SR, ND AND PB ISOTOPIC SYSTEMATICS OF PROTEROZOIC INTRUSIVES
L. D. Ashwal, J. L. Wooden (Geological Survey, Menlo Park, Calif.), and R. F. Emslie (Geological Survey of Canada, Ottawa, Ontario) *In its* Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 17-21 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Sm-Nd and Rb-Sr isotopic compositions of mid to late Proterozoic (approximately 1.6 to 1.1 Ga) massif-type anorthosites and mafic intrusives in the eastern Canadian shield are correlated with geographic location. Complexes in the Grenville province have positive epsilon sub Nd values and initial Sr-87/Sr-86 (I sub Sr) generally less than 0.703, suggesting derivation from depleted mantle. In Labrador, similar complexes close to or northwest of a line roughly corresponding to the Grenville Front have negative epsilon sub Nd values and I sub Sr $>$ 0.703. This contrast was intrepreted as reflecting either enriched mantle under the Nain Province, or contamination of the Nain intrusives with older crustal components. Lead isotopic compositions, however, favor the latter. The possibility of using these Proterozoic intrusives as tracers to characterize the nature and extent of older basement types in Labrador is discussed. Author

N86-28537*# Geological Survey, Anchorage, Alaska.
PARTIAL MELTING OF AMPHIBOLITE TO TRONDHJEMITE NEAR YKUTAT, ALASKA
Fred Barker *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 22 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

At Nunatak Fiord, 55 km NE of Yakutat, Alaska, a uniform layer of Cretaceous metabasalt approximately 3 km thick was metamorphosed to amphibolite facies and locally partially melted to trondhjemite pegmatite. Results of the rare earth element analysis performed on the amphibolite and the trondhjemite pegmatite are discussed. B.G.

N86-28538*# Geological Survey of Canada, Toronto (Ontario).
GEOCHEMISTRY OF GRANITOID ROCKS FROM THE WESTERN SUPERIOR PROVINCE: EVIDENCE FOR 2- AND 3-STAGE CRUSTAL EVOLUTION MODELS
G. P. Beakhouse and R. H. McNutt (McMaster Univ., Hamilton, Ontario) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 23-26 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Superior Province is divisible into subprovinces that can be classified as greenstone-tonalite, paragneiss, or batholitic terranes and are distinguished by differences in lithologic proportions, metamorphic grade, and structural style. The origin and significance of contrasting geochemical characteristics of plutonic rocks from the Winnipeg River subprovince (a batholithic terrane) and the Wabigoon subprovince (a greenstone-tonalite terrane) are discussed. Author

N86-28539*# Geological Survey of Canada, Ottawa (Ontario).
GEOLOGY AND TECTONICS OF THE ARCHEAN SUPERIOR PROVINCE, CANADIAN SHIELD
K. D. Card *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 27-29 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Superior Province consists mainly of Late Archean rocks with Middle Archean gneisses in the south, and possibly in the north. The Late Archean supracrustal sequences are of island arc and interarc affinity and are cut by abundant plutonic rocks, including early arc-related intrusions, late synorogenic intrusions, and post-orogenic plutons that are possibly the product of crustal melting caused by thermal blanketing of newly-thickened continental crust combined with high mantle heat flux. The contemporaneity of magmatic and deformational events along the lengths of the belts is consistent with a subduction-dominated tectonic regime for assembly of the Kenoran Orogen. Successive addition of volcanic arcs accompanied and followed by voluminous plutonism resulted in crustal thickening and stabilization of the Superior craton prior to uplift of Kapuskasing granulites, emplacement of the Matachewan diabase dykes, and Early Proterozoic marginal rifting. Author

N86-28540*# Australian National Univ., Canberra. Research School of Earth Sciences.
STRONTIUM AND NEODYMIUM ISOTOPIC VARIATIONS IN EARLY ARCHEAN GNEISSES AFFECTED BY MIDDLE TO LATE ARCHEAN HIGH-GRADE METAMORPHIC PROCESSES: WEST GREENLAND AND LABRADOR
K. D. Collerson, M. T. McCulloch, D. Bridgwater (Geological Museum, Copenhagen, Denmark), V. R. McGregor (Atammik, Sukkertoppen, Greenland), and A. P. Nutman (Geological Survey of Greenland, Copenhagen, Denmark) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 30-36 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Relicts of continental crust formed more than 3400 Ma ago are preserved fortuitously in most cratons. The cratons provide the most direct information about crust and mantle evolutionary processes during the first billion years of Earth history. In view of their polymetamorphic character, these terrains are commonly affected by subsequent tectonothermal events. Hence, their isotope systematics may be severely disturbed as a result of bulk chemical change or local isotopic homogenization. This leads to equivocal age and source information for different components within these terrains. The Sr and Nd isotopic data are presented for early Archean gneisses from the North Atlantic Craton in west Greenland and northern Labrador which were affected by younger metamorphic events. Author

N86-28541*# Oxford Polytechnic (England). Dept. of Geology and Physical Sciences.
VARYING ROCK RESPONSES AS AN INDICATOR OF CHANGES IN CO2-H2O FLUID COMPOSITION
C. R. L. Friend *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 37-39 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The formation of the late Archean charnockite zone of southern India was ascribed to dehydration recrystallization due to an influx of CO2. Pressure temperature conditions for the metamorphism were calculated at about 750 C and 7.5 Kbar. The composition of the volatile species presently contained in fluid inclusions in the rocks changes across the transition zone. The transition zone was studied at Kabbaldurga and the paths taken by the fluids were identified. B.G.

N86-28542*# Wyoming Univ., Laramie.
DEVELOPMENT OF ARCHEAN CRUST IN THE WIND RIVER MOUNTAINS, WYOMING
C. D. Frost, B. R. Frost, M. E. Koesterer, T. P. Hulsebosch, and D. Bridgwater (Copenhagen Univ., Denmark) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 41-45 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Wind River Mountains are a NW-SE trending range composed almost entirely of high-grade Archean gneiss and granites which were thrust to the west over Phanerozoic sediments during the Laramide orogeny. Late Archean granites make up over 50% of the exposed crust and dominates the southern half of the range, while older orthogneisses and magnatites form most of the northen half of the range. Locally these gneisses contain enclaves of supracrustal rocks, which appear to be the oldest preserved rocks in the range. Detailed work in the Medina Mountain area of the central Wind River Mountains and reconnaissance work throughout much of the northern part of the range has allowed definition of the sequence of events which marked crustal development in this area. The sequence of events are described. Author

N86-28543*# Cornell Univ., Ithaca, N.Y. Dept. of Geological Sciences.
ORIGIN AND EVOLUTION OF THE AMAZONIAN CRATON
A. K. Gibbs and K. R. Wirth *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 46-50 Sponsored in part by Guyana Geological Survey, Utah International, DOCEGEO, ICOMI and B.R.G.M., Direction Guyane (For primary document see N86-28535 19-46)
(Grants NSF EAR-76-17026; NSF EAR-82-07422; NSF EAR-84-10379)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Amazonian craton appears to be formed and modifed by processes much like those of the better-known Precambrian cratons, but the major events did not always follow conventional sequences nor did they occur synchronously with those of other cratons. Much of the craton's Archean style continental crust formation, recorded in granite-greenstone and high-grade terranes, occurred in the Early Proterozoic: a period of relative quiescence in many other Precambrian regions. The common Archean to Proterozoic transition in geological style did not occur here, but an analogous change from abundant marine volcanism to dominantly continental sedimentary and eruptive styles occurred later. Amazonian geology is summarized, explaining the evolution of the craton. B.G.

N86-28544*# Toronto Univ. (Ontario). Dept. of Geology.
CYCLIC GROWTH IN ATLANTIC REGION CONTINENTAL CRUST
A. M. Goodwin *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 51-54 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Atlantic region continental crust evolved in successive stages under the influence of regular, approximately 400 Ma-long tectonic cycles. Data point to a variety of operative tectonic processes ranging from widespread ocean floor consumption (Wilson cycle) to entirely ensialic (Ampferer-style subduction or simple crustal attenuation-compression). Different processes may have operated concurrently in some or different belts. Resolving this remains the major challenge. Author

N86-28545*# Rennes Univ. (France). Inst. de Geologie.
SIGNIFICANCE OF THE Sm-Nd ISOTOPIC SYSTEMATICS OF THE AKILIA ASSOCIATION
G. Grusau, A. Nutman (Geological Survey of Greenland, Copenhagen, Denmark), and B. M. Jahn *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 55-58 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Samarium-Neodymium analyses were carried out on fourteen samples of basic to ultrabasic metavolcanics from several enclaves of the Amitsoq gneisses (T = to or approximately 3,700 Ma). Field observations suggest that all the analyzed rocks belong to the pre-Amitsoq Akilia Association. Consequently, a minimum age of 3,700 Ma is postulated for the emplacement of their protoliths. When all the data points are put together in a conventional isochron diagram, no clear isochron relationship can be discerned. However, the points seem to fall within a band broadly corresponding to an age of 3,600 Ma. The isotopic results are difficult to interpret satisfactorily. Two contrasting interpretations are offered and summarized: (1) data scatter as a result of open system behavior; and (2) data scatter due to a melange of data sets defining two distinct isochrons. Author

N86-28546*# Oxford Univ. (England). Dept. of Earth Sciences.
AGE AND ORIGIN OF GNEISSES SOUTH OF AMERALIK, BETWEEN KANGIMUT-SANGMISSOQ AND QASIGIANGUIT
N. W. Jones, S. Moorbath, and P. N. Taylor *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 59-61 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Gneisses which crop out along the southern coast of Ameralik between Kangimut-sangmissoq and Qasigianguit (K-s-Q) are the subject of long-standing controversy concerning their relationship to the early Archean Amitsoq gneisses of the Godthaab district. On the basis of field observations, it was argued that gneisses at Kangimut-sangmissoq and Qasigianguit are correlatives of the early Archean Amitsoq gneisses. The data were reexamined

and it is concluded that the K-s-Q gneisses represent an addition of substantially juvenile mantle-derived material to the Archean craton of West Greenland during the late Archean times. Some of the parent magmas have undergone interaction with older crust, as indicated by Pb isotope evidence for contamination with Amitsoq-derived Pb. However, the positive epsilon Nd(I) value for the K-s-Q gneisses firmly rules out any significant material contribution from the Amitsoq gneisses to the K-s-Q gneisses. B.G.

N86-28547*# Oregon Univ., Eugene. Dept. of Geology.
ARCHEAN METAMORPHIC SEQUENCE AND SURFACES, KANGERDLUGSSUAQ FJORD, EAST GREENLAND
M. A. Kays *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 63-67 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The characteristics of Archean metamorphic surfaces and fabrics of a mapped sequence of rocks older than about 3000 Ma provide information basic to an understanding of the structural evolution and metamorphic history in Kangerdlugssuaq Fjord, east Greenland. This information and the additional results of petrologic and geochemical studies have culminated in an extended chronology of Archean plutonic, metamorphic, and tectonic events. The basis for the chronology is considered, especially the nature of the metamorphic fabrics and surfaces in the Archean sequence. The surfaces, which are planar mineral parageneses, may prove to be mappable outside Kangerdlugssuaq Fjord, and if so, will be helpful in extending the events that they represent to other Archean sequences in east Greenland. The surfaces will become especially important reference planes if the absolute ages of their metamorphic assemblages can be determined in at least one location where strain was low subsequent to their recrystallization. Once an isochron is obtained, the dynamothermal age of the regionally identifiable metamorphic surface is determined everywhere it can be mapped. Author

N86-28548*# Oregon Univ., Eugene. Dept. of Geology.
METAMORPHOSED ULTRAMAFIC ROCKS IN EAST GREENLAND
M. A. Kays and M. J. Dorais (Georgia Univ., Athens) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 68-70 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The compositional and mineralogical characteristics of Archean ultramafic rocks in Kangerdlugssuaq Fjord are summarized: the first provides information important to understanding the primary character of the rock suite, whereas the latter provides data necessary to determine the conditions of their equilibrium during the latest metamorphism. This information will be of value in determining the affinity of the suite to similar Archean rocks in other areas of the North Atlantic craton. Author

N86-28549*# Wisconsin Univ., Oskosh. Dept. of Geology.
A MODEL FOR THE BIOLOGICAL PRECIPITATION OF PRECAMBRIAN IRON-FORMATION
Gene L. LaBerge *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 71-75 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

A biological model for the precipitation of Precambrian iron formations is presented. Assuming an oxygen deficient atmosphere and water column to allow sufficient Fe solubility, it is proposed that local oxidizing environments, produced biologically, led to precipitation of iron formations. It is further suggested that spheroidal structures about 30 mm in diameter, which are widespread in low grade cherty rion formations, are relict forms of the organic walled microfossil Eosphaera tylerii. The presence of these structures suggests that the organism may have had a siliceous test, which allowed sufficient rigidity for accumulation and preservation. The model involves precipitation of ferric hydrates by oxidation of iron in the photic zone by a variety of photosynthetic organisms. Silica may have formed in the frustules of silica secreting organisms, including Eosphaera tylerii. Iron formates formed, therefore, by a sediment rain of biologically produced ferric hydrates and silica and other organic material. Siderite and hematite formed diagenetically on basin floors, and subsequent metamorphism produced magnetite and iron silicates. Author

N86-28550*# Louisiana State Univ., Baton Rouge. Dept. of Geology.
ARCHEAN SEDIMENTARY STYLES AND EARLY CRUSTAL EVOLUTION
Donald R. Lowe *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 76-77 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The distinctions between and implications of early and late Archean sedimentary styles are presented. Early Archean greenstone belts, such as the Barberton of South Africa and those in the eastern Pilbar Block of Australia are characterized by fresh or slightly reworked pyroclastic debris, orthochemical sediments such as carbonates, evaporites, and silica, and biogenic deposits including cherts and stromatolitic units. Terrigenous deposits are rare, and it is suggested that early Archean sediments were deposited on shallow simatic platforms, with little or no components derived from sialic sources. In contrast, late Archean greenstone belts in the Canadian Shield and the Yilgarn Block of Australia contain coarse terrigenous clastic rocks including conglomerate, sandstone, and shale derived largely from sialic basement. Deposition appears to have taken place in deepwater, tectonically unstable environments. These observations are interpreted to indicate that the early Archean greenstone belts formed as anorogenic, shallow water, simatic platforms, with little or no underlying or adjacent continental crust, an environment similar to modern oceanic islands formed over hot spots. Author

N86-28551*# Memorial Univ. of Newfoundland, St. Johns. Dept. of Earth Sciences.
REGIONAL VARIATION IN THE AMITSOQ GNEISSES RELATED TO CRUSTAL LEVELS DURING LATE ARCHEAN GRANULITE FACIES METAMORPHISM: SOUTHERN WEST GREENLAND
A. P. Nutman, D. Bridgwater (Geological Museum, Copenhagen, Denmark), and V. R. McGregor (Atammik, Sukkertoppen, Greenland) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 78-83 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The dominant lithology at Kangimut sangmissoq is described as nebulitic tonalitic gneiss containing highly distended plagioclase phyric amphibolites. The gneiss amphibolite complex was intruded by Nuk gneiss between 3.05 and 2.90 Ga and later (2.6 to 2.7 Ga) by post granulite facies granitoid sheets. The amphibolites are though to be Ameralik dikes and the older gray gneiss are then Amitsoq by definition. The problem arises when the isotopic data are considered, none of which indicate rocks older that about 3.0 Ga. Author

N86-28552*# Geological Survey of Canada, Ottawa (Ontario).
METAMORPHISM AND PLUTONISM IN THE QUETICO BELT, SUPERIOR PROVINCE, N.W. ONTARIO
J. A. Percival *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 84-85 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Quetico Belt lies between the metavolcanic Wawa-Shebandowan and Wabigoon Belts. It consists of marginal metasedimentary rocks and central pelitic, gneissic and plutonic rocks. Metamorphism is Barrovian, at depths less than 10 km, and grade increases from margins to core of the belt: the outermost pelites are at chlorite-muscovite grade; inward a garnet-andalusite zone formed throughout the inner margin; and the central zone ranges form garnet-andalusite in the west and garnet-sillimanite-muscovite to garnet-sillimanite-cordierite and rare kyanite 6 to 150 km to the east. This increase is correlated with

granitic intrusives. Migmatites in the core have intrusive leucosomes in the west and locally derived ones in the east. Isograd surfaces are steep where the belt is narrow and dip gently where it is wide. The Quetico Park intrusive complex of the central region of the Quetico Belt shows a zonation across it 20 to 50 km width from older, medium grained biotite composition to younger, coarse to pegmatitic granitic composition. Sediment of the Quetico basin had its source in the bordering metavolcanic belts and was deposited ca. 2.75 to 2.70 Ga ago. Boundaries of the belt dip inward, so it essentially is a graben of inter-arc or back-arc type.
Author

N86-28553*# Geological Survey, Denver, Colo.
EARLY ARCHEAN TONALITE GNEISS IN THE UPPER PENINSULA OF MICHIGAN
Zell E. Peterman, R. E. Zartman, and P. K. Sims *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 86-89 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Geochronological results on tonalite gneiss of northern Michigan that is 3.56 Ga or slightly older is presented. Tonalitic augen gneiss and structurally overlying biotite gneiss and schist are exposed in a dome near Watersmeet. They are part of an extensive gneiss terrane of southern Minnesota, Wisconsin and Michigan that includes rocks of early to late Archean ages and lies south of the Wawa volcanic subprovince. Two samples of the augen gneiss and one of the biotite gneiss show zircon grains of similar shape, zoning, color, and development of crystal faces. These zircons give Pb/U isotopic ratios that plot on a chord of 3,560 + or - 40 m.y. upper intersect and of 1,250 + or m.y. lower intersect. The 3,560 m.y. number is believed to be a minimum age because analysis of one of the least discordant zircon fractions by ion microprobe that gave a nearly concordant age of 3,650 m.y. The 1,250 m.y. lower intersect is without geological significance: it is interpreted to be a result of multiple lead loss at 2.7, 1.8, and 0.5 Ga by U/Pb in zircon. Archean rocks 10 to 25 km northwest of the Watersmeet dome give a 2.75 Ga age on zircons. Quartz monzonite here is dated at 2.65 Ga.
Author

N86-28554*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PETROGENESIS OF CALCIC PLAGIOCLASE MEGACRYSTS IN ARCHEAN ROCKS
W. C. Phinney and D. A. Morrison (Lockheed Engineering and Management Services Co., Inc., Houston, Tex.) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 90-91 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Anorthositic complexes with large equidimensional plagioclase grains of highly calcic composition occur in nearly all Archean cratons. Similar plagioclase occur as megacrysts in many Archean sills, dikes, and volcanic flows. In the Canadian Shield these units occur throughout the Archean portions of the entire shield and are particularly common as dikes over an area of a few 100,000 sq km in Ontario and Manitoba during a period of at least 100 m.y. in many different rock types and metamorphic grades. The plagioclase generally occurs in three modes: as inclusions in mafic intrusions at various stages of fractionation, as crystal segregations in anorthosite complexes, or as megacrysts in fractionated sills, dikes, and flows. Most occurrences suggest that the plagioclase was formed elsewhere before being transported to its present location. The evidence seems to be quite clear that occurrences of these types of calcic plagioclase require: (1) ponding of a relatively undifferentiated Archean tholeiitic melt at some depth; (2) isothermal crystallization of large, equidimensional homogeneous plagioclase crystals; (3) separation of the plagioclase crystals from any other crystalline phases; (4) further fractionation of melt; (5)transport of various combinations of individual plagioclase crystals and clusters of crystals by variously fractionated melts; and (6) emplacement as various types of igneous intrusions or flows.
Author

N86-28555*# Geological Museum, Copenhagen (Denmark).
INTRUSIONS OF MIXED ORIGIN MIGMATISING EARLY ACHAEAN CRUST IN NORTHERN LABRADOR, CANADA
L. Schiotte and D. Bridgwater *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 93-97 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Migmatization of Early Archean Uivak gneisses by Late Archean granitic and trondhjemitic injections are described. The rare earth element, major element, and isotopic geochemistry of the felsic sheets is interpreted to indicate both mantle and crustal components, and the sheets with associated fluids were the vehicle for element transport in the crustal column with attendant isotopic modification of the older gneisses.
Author

N86-28556*# Wyoming Univ., Laramie. Program for Crustal Studies.
SOME EXAMPLES OF DEEP STRUCTURE OF THE ARCHEAN FROM GEOPHYSICS
S. B. Smithson, R. A. Johnson, and W. R. Pierson *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 98-102 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The development of Archean crust remains as one of the significant problems in earth science, and a major unknown concerning Archean terrains is the nature of the deep crust. The character of crust beneath granulite terrains is especially fascinating because granulites are generally interpreted to represent a deep crustal section. Magnetic data from this area can be best modeled with a magnetized wedge of older Archean rocks (granulitic gneisses) underlying the younger Archean greenstone terrain. The dip of the boundary based on magnetic modeling is the same as the dip of the postulated thrust-fault reflection. Thus several lines of evidence indicate that the younger Archean greenstone belt terrain is thrust above the ancient Minnesota Valley gneiss terrain, presumably as the greenstone belt was accreted to the gneiss terrain, so that the dipping reflection represents a suture zone. Seismic data from underneath the granulite-facies Minnesota gneiss terrain shows abundant reflections between 3 and 6 s, or about 9 to 20 km. These are arcuate or dipping multicyclic events indicative of layering.
Author

N86-28557*# Oxford Univ. (England). Dept. of Earth Sciences.
Pb ISOTOPIC EVIDENCE FOR EARLY ARCHAEAN CRUST IN SOUTH GREENLAND
Paul N. Taylor and Feiko Kalsbeek (Geological Survey of Greenland, Copenhagen, Denmark) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 103-106 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The results of an isotopic remote sensing study focussed on delineating the extent of Early Archean crust north and south of the Nuuk area and in south Greenland is presented. Contamination of the Late Archean Nuk gneisses and equivalents by unradiogenic Pb uniquely characteristic of Amitsoq gneiss was detected as far south as Sermilik about 70 km south of Nuuk and only as far north as the mouth of Godthabsfjord. This study was extended to the southern part of the Archean craton and the adjoining Early Proterozoic Ketilidian orogenic belt where the Pb isotopes suggest several episodes of reworking of older uranium depleted continental crust. The technique of using the Pb isotope character of younger felsic rocks, in this case Late Archean and Early Proterozoic gneisses and granites to sense the age and isotopic character of older components, is a particularly powerful tool for reconstructing the evolutionary growth and development of continental crust.
Author

N86-28558*# Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
FLUID-ABSENT METAMORPHISM IN THE ADIRONDACKS
John W. Valley *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 107-111

(For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

Results on late Proterozoic metamorphism of granulite in the Adirondacks are presented. There more than 20,000 sq km of rock are at granulite facies. Low water fugacites are implied by orthopyroxene bearing assemblages and by stability of k'spar-plag-quartz assemblages. After mentioning the popular concept of infiltration of carbon dioxide into Precambrian rocks and attendent generation of granulite facies assemblages, several features of Adirondack rocks pertinent to carbon dioxide and water during their metamorphism are summarized: wollastonite occurs in the western lowlands; contact metamorphism by anorthosite preceeding granulite metamorphism is indicated by oxygen isotopes. Oxygen fugacity lies below that of the QFM buffer; total P sub water + P sub carbon dioxide determined from monticellite bearing assemblages are much less than P sub total (7 to 7.6 kb). These and other features indicate close spatial association of high- and low-P sub carbon dioxide assemblages and that a vapor phase was not present during metamorphism. Thus Adirondack rocks were not infiltrated by carbon dioxide vapor. Their metamorphism, at 625 to 775 C, occurred either when the protoliths were relatively dry or after dessication occurred by removal of a partial melt phase. Author

N86-28559*# Atammik, Sukkertoppen (Greenland).
THE ARCHEAN GEOLOGY OF THE GODTHABSFJORD REGION, SOUTHERN WEST GREENLAND (INCLUDES EXCURSION GUIDE)
V. R. McGregor, A. P. Nutman (Memorial Univ. of Newfoundland, St. Johns), and C. R. L. Friend (Oxford Polytechnic, England) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 113-169 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

The part of the West Greenland Archean gneiss complex centered around Godthabsfjord and extending from Isukasia in the north to south Faeringehavn is studied. Extensive outcrops of 3800 to 3400 Ma rocks can provide some direct evidence of conditions and processes that operated on the Earth in the early Archean. However, the ways in which primary characteristics have been modified by later deformation, metamorphism, and chemical changes are first taken into account. The rocks exposed are the products of two major phases of accretion of continental crust, at 3800 to 3700 Ma and 3100 to 29 Ma. The main features of these two accretion phases are similar, but careful study of the least modified rocks may reveal differences related to changes in the Earth in the intervening period. The combination of excellent exposure over an extensive area, relatively detailed geological mapping of much of the region, and a considerable volume of isotopic and other geochemical data gives special insights into processes that operated at moderately deep levels of the crust in the Archean. Of particular interest is the effect of late Archean granulite facies metamorphism on early Archean rocks, especially the extent to which isotope systems were disturbed. Similar processes may well have partly or wholly destroyed evidence of more ancient components of other high grade terrains. This account does not attempt to be an exhaustive review of all work carried out on the geology of the region. Rather, it attempts to summarize aspects of the geology and some interest in the context of early crustal genesis. Author

N86-28560*# Memorial Univ. of Newfoundland, St. Johns. Dept. of Earth Sciences.
ISUKASIA AREA: REGIONAL GEOLOGICAL SETTING (INCLUDES EXCURSION GUIDE)
A. P. Nutman and M. Rosing (Geological Museum, Copenhagen, Denmark) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks 1986 p 171-184 (For primary document see N86-28535 19-46)
Avail: NTIS HC A09/MF A01 CSCL 08G

A brief account of the geology of the Isukasis area is given and is biased toward the main theme of the itinerary for the area: What has been established about the protoliths of the early Archean rocks of the area - the Isua supracrustal belt and the Amitsoq gneisses? The area's long and complex tectonometamorphic history of events can be divided into episodes using a combination of dike chronology, isotopic, and petrological studies. The earliest dikes, the ca 3700 Ma Inaluk dikes, intrude the earliest (tonalitic) components of the Amitsoq gneisses but are themselves cut up by the injection of the younger (granitic and pegmatitic) phases of the Amitsoq gneisses of the area. The areas of low late Archean deformation, strongly deformed early Archean mafic rocks have coarse grained metamorphic segregations and are cut by virtually undeformed mid-Archean Tarssartoq (Ameralik) dikes devoid of metamorphic segregations. The shows that the area was affected by regional amphibolite facies metamorphism in the early Archean. Late Archean and Proterozoic metamorphic imprints are marked to very strong in the area. Much of the early Archean gneiss complex was already highly deformed when the mid-Archean Tarssartoq dikes were intruded. Author

N86-28561*# National Aeronautics and Space Administration, Washington, D.C.
EVOLUTION OF A METEORITE CRATER AS A PROCESS OF RANDOM DISPLACEMENTS
I. T. Zotkin and A. I. Dabizha Jun. 1986 18 p Transl. into ENGLISH from Meteoritika, Adademiya Nauk SSSR (USSR), no. 40, 1982 p 82-90 Transl. by The Corporate Word, Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-88428; NAS 1.15:88428) Avail: NTIS HC A02/MF A01 CSCL 08G

An examination of the ages and sizes of 114 terrestrial impact craters shows that their aging kinetics can be described by the diffusion laws. The macrodiffusion coefficient which determines random displacements of mineral masses on the Earth has a mean value of 0.02 sq m/year. The amount of matter in a crater that contains information about the impact event decreases with time according to the 1/T law. The basic characteristic parameter of a crater is its initial area, inasmuch as sufficiently large craters are nearly surficial formations. The relaxation time of a crater is proportional to its initial area. Author

N86-28562*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SAM 2 MEASUREMENTS OF THE POLAR STRATOSPHERIC AEROSOL, VOLUME 2 Report, Oct. 1981 - Apr. 1982
M. Patrick McCormick and David Brandl (SASC Technologies, Inc., Hampton, Va.) Aug. 1986 78 p
(NASA-RP-1164; L-16105; NAS 1.61:1164) Avail: NTIS HC A05/MF A01 CSCL 04A

The Stratospheric Aerosol Measurement (SAM) 2 sensor aboard Nimbus 7 is providing extinction measurements of Antarctic and Arctic stratospheric aerosols with a vertical resolution of 1 km. Representative examples and weekly averages including corresponding temperature profiles provided by NOAA for the time and place of each SAM 2 measurement (Oct. 1981 - Apr. 1982) are presented. Contours of aerosol extinction as a function of altitude and longitude or time are plotted, and aerosol optical depths are calculated for each week. Typical values of aerosol extinction at 1.0 micron in the main lower stratospheric aerosol layer for this time period are 2 to 4 times 10 to the -4 power/km. for the Antarctic region and 0.5 to 1 times 10 to the -3 power/km. for the Arctic region. Stratospheric optical depths are about 0.001 to 0.004 for the Antarctic region and 0.003 to 0.004 at the beginning to about 0.006 at the end of the time period for the Arctic region. Polar stratospheric clouds (PSC's) were observed during the Arctic winter, as expected. This report provides, in a ready-to-use format, a representative sample of the seventh semester of data to be used in atmospheric and climatic studies. Author

N86-28563# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
THE ESTIMATION OF GEOPOTENTIALS BY WAY OF GEOPHYSICAL INVERSE THEORY
Mark T. Lane and Edward M. Gaposchkin 27 Jan. 1986 33 p

(Contract F19628-85-C-0002)
(AD-A165691; TR-735; ESD-TR-85-279) Avail: NTIS HC A03/MF A01 CSCL 08/5

Satellite to satellite tracking data (SST) can be used to measure the geopotential at the satellite altitude. This measurement can be used to estimate the Earth's gravity field at the Earth's surface, the so-called inverse problem. Geophysical inverse theory is applied to this inverse problem, and numerical methods are developed and tested. Geophysical inverse theory is used to map the geopotential from the satellite altitude to a lower surface. Two configurations are explored and the geopotential in a local network is recovered with less than 4% error. GRA

N86-28564# Geological Survey, Menlo Park, Calif.
THREE-DIMENSIONAL P-VELOCITY STRUCTURE OF THE SUMMIT CALDERA OF NEWBERRY VOLCANO, OREGON
Douglas A. Stauber, N. M. Iyer, Walter D. Mooney, and Phillip B. Dawson 1985 5 p
(Contract DE-AI01-79RA-50294)
(DE86-005740; DOE/RA-50294/T4) Avail: NTIS HC A02/MF A01

A three-dimensional high-resolution seismic study of the summit caldera of Newberry Volcano, Oregon, was conducted by the U. S. Geological Survey using an adaptation of the method applied by Mercessian (1984). Preliminary interpretation of the traveltime residuals reveals a ring of high P-velocity material coinciding with the inner ring fault system of the caldera in the upper 2 km. A zone of lower P-velocities extends deeper than 2 km in the center of the caldera. Author

N86-28565# Stockholm Univ. (Sweden). Dept. of Meteorology.
THEORY AND OBSERVATIONS OF GRAVITY WAVES IN AN INVERSION LAYER
Ingemar Carlsson 30 Oct. 1985 52 p
(DM-46; ISSN-0349-0467; ESA-86-97058) Avail: NTIS HC A04/MF A01

In order to study how gravity wave oscillations in an inversion are modified by conditions in the surrounding atmosphere, a three layer model was derived. If the waves induced in the atmosphere have a horizontal wavelength of the same order or shorter than the thickness of the inversion, the resulting resonance frequency is very close to the Brunt-Vaisala frequency of the inversion which varies with the stability. The measured frequency of the oscillations in the integrated amount of precipitable water vapor are used to determine the lapse rate in the inversion. All this information can be used as complementary conditions for the retrieval of temperature and humidity profiles from radiometer data to increase height resolution. ESA

N86-28566# Stockholm Univ. (Sweden). Dept. of Meteorology.
A FEASIBILITY STUDY ON SELECTIVE IONIZATION MASS SPECTROMETRY OF NITRIC OXIDE AND ITS APPLICATION IN THE UPPER ATMOSPHERE
Ronny Carlsson and Andre Zuber 28 Nov. 1985 43 p Sponsored by Swedish Board for Space Activities
(AP-26; ISSN-0280-4441; ESA-86-97056) Avail: NTIS HC A03/MF A01

A laboratory model of a photoionization mass spectrometer was built by modifying a commercial quadrupole mass intensity Kr low pressure lamp to selectively ionize NO. The characteristics of the photoionization mass spectrometer were determinated with respect to mass resolution, ion energy, and focusing potential. The sensitivity of the model instrument was determined to be 1.5 times 10 to the minus 9th power A/Torr for NO at a mass resolution of 1 AMU. This result shows that the present instrument is not sensitive enough for measuring mesospheric and thermospheric abundances of NO from a rocket. ESA

N86-28567# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
IONOSPHERIC STREAMS AT ALTITUDES BELOW 14RE
S. Orsini and M. Candidi Sep. 1985 29 p
(IFSI-85-10; ESA-86-97094) Avail: NTIS HC A03/MF A01

The properties of ionospheric ion streams flowing away from Earth into the magnetotail between 2 Re and 14 Re are studied from ISEE-2 data. General agreement between these observations and those at lower and larger distances is found, indicating that the plasma sheet is enriched with ionospheric ions at all distances. ESA

N86-28568# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
THE TEMAG EXPERIMENT FOR THE TETHERED SATELLITE SYSTEM (TSS)
E. Mariani (Rome Univ, Italy), M. Candidi, and R. Terenzi Oct. 1985 41 p
(IFSI-85-14; ESA-86-97098) Avail: NTIS HC A03/MF A01

An experiment to provide rapid (up to 20 vector/sec), and accurate vector measurements of the magnetic field at ionospheric altitudes is introduced. Although the engineering nature of the mission limits the scientific performance of the onboard instrumentation, scientific objectives can be pursued. Electrodynamic and atmospheric mission objectives include study of the ionospheric currents and the anomalies of the Earth's magnetic field. The electrodynamic mission also studies the magnetic signature of the tether current. Secondary objectives, for all missions, include the use of magnetic data in the understanding of the dynamical behavior of the satellite and as auxiliary data for particule data interpretation. The basic instrument is a fluxgate triaxial magnetometer mounted on an equatorial fixed boom, with the possibility of adding a second similar instrument closer to the satellite to help in determing the residual contaminating fields. ESA

N86-28569# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
DETERMINATION OF THE RADIATION BUDGET AT THE TOP OF THE ATMOSPHERE OVER THE SAHARA USING SATELLITE MEASUREMENTS [BESTIMMUNG DER STRAHLUNGSBILANZ AM OBERRAND DER ATMOSPHAERE UEBER DER SAHARA AUS SATELLITENMESSUNGEN]
M. Wiegner, A. Ebel, ed., F. M. Neubauer, ed., E. Raschke, ed., and P. Speth, ed. 1985 80 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(Mitt-43; ISSN-0069-5882; ESA-86-96917) Avail: NTIS HC A05/MF A01

A method based on satellite systems was developed in order to study one aspect of the energy balance of the system Earth-atmosphere, namely the radiation budget at the top of the atmosphere. The anisotropy of the radiation field and the spectral sampling of the instrument are taken into account. Measuring data from the NIMBUS-7-ERB radiometer and the visible and IR-channel of METEOSAT during the period from June 16 to June 31, 1979 were taken. The measurements of the geostationary satellite were calibrated and used for spatial and temporal integration of the NIMBUS-7 data; they are also needed for scene identification. Results show a negative net flux over most parts of the Sahara, in particular over the eastern regions. ESA

N86-28570# Natural Environmental Research Council, Edinburgh (Scotland). Geomagnetism Research Group.
MAGNETIC RESULTS, 1983, 1984: ESKDALEMUIR, HARTLAND AND LERWICK OBSERVATORIES
1985 136 p
(GEOMAGNETIC-BULL-16; ISBN-0-85272-083-1; ESA-86-97123) Avail: NTIS HC A07/MF A01

The results of the standard observations carried out at the magnetic laboratories during 1983-84 are presented. The measurements show hourly means of horizontal and vertical intensity and hourly means of magnetic declination. Diurnal extreme values and mean diurnal inequalities are also given. ESA

N86-28571# National Center for Atmospheric Research, Boulder, Colo.
PRELIMINARY EVALUATION STUDIES WITH THE REGIONAL

ACID DEPOSITION MODEL (RADM) Interim Report, 1 Jan. - 31 Dec. 1985
Mar. 1986 207 p Sponsored by EPA and NSF
(PB86-175692; EPA-600/3-86-024) Avail: NTIS HC A10/MF A01 CSCL 04A

The findings of preliminary evaluation studies of the NCAR Regional Acid Deposition Modeling System (RADM) are discussed. Current efforts in evaluating the gas-phase chemistry submodel have met with significant success. An understanding of the smog chamber databases has also been developed. RADM forecasts of sulfate and nitrate wet deposition for the first day of OSCAR IV are quite good. The RADM-simulated three-dimensional chemical species distributions are very consistent with preliminary data measured by National Center for Atmospheric Research (NCAR) under a separate program. The first test of RADM's ability to analyze what if studies with hypothetical reductions in sulfur emissions is demonstrated. The findings confirm the complexity of directly observing potential benefit from emissions reductions. Author

N86-28572# Kanner (Leo) Associates, Redwood City, Calif.
EXCITATION OF ELECTROSTATIC WAVE TURBULENCE IN IONOSPHERE AS ONE EFFECT OF SEISMIC ACTIVITY
M. B. Gokhberg, I. L. Gufeld, A. V. Kustov, V. A. Liperovskii, A. M. Buloshnikov, V. A. Pilipenko, O. A. Pokhotelov, and S. L. Shalimov 1985 41 p Transl. into ENGLISH of "Vozbuzhdenie Elektrostaticheskoi Volnovoi Turbulentnosti v Ionosfere Kak Odin iz Effektov Seismicheskoi Aktivnosti" Preprint no. 16 Moscow, USSR, 1983
(Contract W-7405-eng-36)
(TI86-025135; LA-TR-85-62) Avail: NTIS HC A03/MF A01

A possible scenario of the buildup of a chain of geophysical phenomena is proposed associating processes in terra firma in the concluding stage of earthquake presaging and bursts of wave turbulence in the ionosphere observed on satellites. Author

N86-28276*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOTAL IONOSPHERIC ELECTRON CONTENT CALIBRATION USING SERIES GPS SATELLITE DATA
G. Lanyi *In its* The Telecommunications and Data Acquisition Report 15 May 1986 12 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 04A

N86-28422*# Science Research Council, Chilton (England). Rutherford Appleton Lab.
LOWER THERMOSPHERE DENSITIES OF N2, O AND Ar UNDER HIGH LATITUDE WINTER CONDITIONS
Paul H. G. Dickinson, U. vonZahn (Bonn Univ., West Germany), K. D. Baker (Utah State Univ., Logan), and D. B. Jenkins (University Coll. of Wales, Aberystwyth) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 Jun. 1986 p 321-328 Pergamon Press Ltd. Repr. from Journal of Atmospheric and Terrestrial Physics (England), v. 47, no. 1-3, 1985 p 283-290 (For primary document see N86-28407 19-37)
Avail: NTIS HC A25/MF A01 CSCL 13I

N86-28494# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE USE OF SAR SYSTEMS FOR GEOLOGICAL APPLICATIONS
F. Jaskolla (Ludwig-Maximilians-Universitaet, Munich, West Germany), M. Rast, and J. Bodechtel *In its* Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 41-50 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-28573# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
PERFORMANCE EVALUATION OF THE NEXRAD (NEXT GENERATION WEATHER RADAR) HALL ALGORITHM APPLIED TO COLORADO THUNDERSTORMS
J. R. Smart Sep. 1985 37 p
(PB86-168374; NOAA-TM-ERL-ESG-18) Avail: NTIS HC A03/MF A01 CSCL 04B

The relationship between the NEXRAD (next generation weather radar) storm identification algorithms and the Hail Algorithm is described. Skill scores are used to evaluate the performance of the Hail Algorithm when applied to radar reflectivity data for Colorado thunderstorms whose precipitation phenomena were verified by field observers. The Hail Algorithm successfully diagnoses the multiple pulse (long-lived) severe hailstorms while having no skill for diagnosing single pulse (short-lived) severe hailstorms. The best hail indicators far distinguishing between severe hailstorms and non-hail thunderstorms are the storm maximum reflectivity greater than or equal to 55 cBz and mid-level (5 to 12 kilometers) reflectivity greater than 50 dBZ. GRA

N86-28574*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SURFACE RADIATION BUDGET FOR CLIMATE APPLICATIONS
J. T. Suttles, ed. and G. Ohring, ed. (National Oceanic and Atmospheric Administration, Washington, D. C.) Aug. 1986 123 p
(NASA-RP-1169; L-16133; NAS 1.61:1169) Avail: NTIS HC A07/MF A01 CSCL 04B

The Surface Radiation Budget (SRB) consists of the upwelling and downwelling radiation fluxes at the surface, separately determined for the broadband shortwave (SW) (0 to 5 micron) and longwave (LW) (greater than 5 microns) spectral regions plus certain key parameters that control these fluxes, specifically, SW albedo, LW emissivity, and surface temperature. The uses and requirements for SRB data, critical assessment of current capabilities for producing these data, and directions for future research are presented. B.G.

N86-28575*# Illinois Univ., Champaign. Climate and Meteorology Section.
A VARIATIONAL ASSIMILATION METHOD FOR SATELLITE AND CONVENTIONAL DATA: DEVELOPMENT OF BASIC MODEL FOR DIAGNOSIS OF CYCLONE SYSTEMS Final Report
G. L. Achtemeier, H. T. Ochs, III, S. Q. Kidder, R. W. Scott, J. Chen, D. Isard, and B. Chance May 1986 227 p
(Contract NAS8-34902)
(NASA-CR-3981; NAS 1.26:3981) Avail: NTIS HC A11/MF A01 CSCL 04B

A three-dimensional diagnostic model for the assimilation of satellite and conventional meteorological data is developed with the variational method of undetermined multipliers. Gridded fields of data from different type, quality, location, and measurement source are weighted according to measurement accuracy and merged using least squares criteria so that the two nonlinear horizontal momentum equations, the hydrostatic equation, and an integrated continuity equation are satisfied. The model is used to compare multivariate variational objective analyses with and without satellite data with initial analyses and the observations through criteria that were determined by the dynamical constraints, the observations, and pattern recognition. It is also shown that the diagnoses of local tendencies of the horizontal velocity components are in good comparison with the observed patterns and tendencies calculated with unadjusted data. In addition, it is found that the day-night difference in TOVS biases are statistically different (95% confidence) at most levels. Also developed is a hybrid nonlinear sigma vertical coordinate that eliminates hydrostatic truncation error in the middle and upper troposphere and reduces truncation error in the lower troposphere. Finally, it is found that the technique used to grid the initial data causes boundary effects to intrude

into the interior of the analysis a distance equal to the average separation between observations. Author

N86-28576# Miami Univ., Fla. School of Marine and Atmospheric Science.

ENVIRONMENTAL CONDITIONS ASSOCIATED WITH THE OCCURRENCE OF LARGE SCALE DUST STORMS IN ARID REGIONS OF NORTH AFRICA Final Report, 1 Jun. 1983 - 30 Nov. 1985

J. M. Prospero, D. M. Helgren, M. Estoque, and J. Fernandez-Partagas 28 Feb. 1986 23 p
(Contract DAAG29-83-K-0082)
(AD-A165662; ARO-19684.1-GS) Avail: NTIS HC A02/MF A01 CSCL 04/2

Dust storms are complex phenomena that are dependent on many meteorological and environmental factors. Because they normally occur in remote and inhospitable regions, they have been studied relatively little. Such studies are further hampered by the dearth of meteorological, climatological and geological data for such regions. In particular, the occurrence of the major storms seems to be related to identifiable meteorological conditions. Such storms should be predictable with a fair degree of confidence. Likewise, it is clear that there are a wide variety of terrains that can serve as dust sources given the right meteorological conditions. However, the truly great storms appear to occur in a relatively well-defined region of the western Sahara, west and southwest of the Ahaggar masif. There are many terrains in this region that can serve as dust sources. The dimensions of the storm appear to be controlled by the wind field. Sources in these areas are clearly very important and could control the aerosol characteristics over a large area of West Africa and the tropical and subtropical North Atlantic. , Remote sensing, Haze, Deflation. GRA

N86-28577# Miami Univ., Fla. School of Marine and Atmospheric Science.

THRESHOLD WIND VOLOCITIES FOR RAISING DUST IN THE WESTERN SAHARA

J. Fernandez-Partagas, D. M. Helgren, and J. M. Prospero Jan. 1986 19 p
(Contract DAAG29-83-K-0082)
(AD-A165761; ARO-19684.3-GS) Avail: NTIS HC A02/MF A01 CSCL 04/2

Data from eight meteorological stations in the western Sahara for the period July 1 - August 15, 1974 indicate an average threshold wind velocity of about 8 m/s for raising dust. Station-to-Station variations in the threshold wind velocity are relatively large and range from 5 m/s to 12.5 m/s. However, at most stations the threshold velocity appears to be a reproducible characteristic of the environment. Threshold velocity variations appear to be attributable in part to differences in soil and terrain characteristics at the stations. Author (GRA)

N86-28578# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.

ATMOSPHERIC CONDITIONS IN THE MIDDLE EAST

Dorathy A. Stewart, Oskar M. Essenwanger, and Larry J. Levitt Jun. 1985 71 p
(AD-A165795; AD-E950800; AMSMI/RR-85-3-TR) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report describes atmospheric conditions in the Middle East. This area is defined here as Iran, Iraq, the Arabian Peninsula, Syria, Lebanon, Jordan, Israel, and Egypt. A detailed discussion of the extreme variability of precipitation in both space and time is given. Available information about temperature, humidity, fog, dust storms, and solar energy is summarized. Tables of three-hourly seasonal data for Tel Aviv, Jerusalem, Dhahran, Baghdad, and Tehran are included. These tables list means and standard deviations of temperature, dew point, absolute humidity, and wind speed. Maximum and minimum absolute humidities are also included. Visibility and cloud cover are described by frequency distributions. Author (GRA)

N86-28579# Nevada Univ., Las Vegas. Water Resources Center.

ADDITIONAL INTENSITY DURATION ANALYSES AND DESIGN HYETOGRAPH PARAMETERS FOR VARIOUS PRECIPITATION STATIONS OF THE NEVADA TEST SITE, NEVADA

R. H. French Aug. 1985 34 p
(Contract DE-AC08-85NV-10384)
(DE86-002799; DOE/NV-10384/02) Avail: NTIS HC A03/MF A01

The report presents the most current results for intensity-duration-frequency and dimensionless hyetograph parameter estimation on the Nevada Test Site. Specifically the precipitation stations for which data are presented in this report are: (1) Rock Valley; (2) Desert Rock; (3) Mercury; (4) Mid Valley; (5) Yucca; (6) 40MN; and (7) BJY. DOE

N86-28580# Massachusetts Univ., Amherst.

STUDIES OF CLIMATIC VARIABILITY DURING THE PERIOD OF INSTRUMENTAL RECORDS

R. S. Bradley, P. M. Kelly (East Anglia Univ., Norwich, England.), P. D. Jones, and H. Diaz (National Oceanic and Atmospheric Administration, Boulder, Colo.) Dec. 1985 29 p
(Contract DE-FG02-85ER-60316)
(DE86-005506; DOE/ER-60316/1) Avail: NTIS HC A03/MF A01

The report discusses progress in: (1) gridding and analysis of long-term precipitation data for northern hemisphere land areas; (2) homogeneity testing of long-term temperature data for northern hemisphere land areas and assessment of the importance of urbanization and changing spatial data coverage on the record; (3) evaluation of the influence of various forcing factors on the temperature record of the last 130 years; and (4) evaluation of the Comprehensive Ocean-Atmosphere Data Set (COADS) in preparation for merging with the DOE land data set. DOE

N86-28581# Designwrights Collaborative, Santa Fe, N. Mex.

NEW MEXICO CLIMATE MANUAL: SOLAR AND WEATHER DATA Final Report

W. S. Morris and K. Haggard Nov. 1985 608 p
(DE86-900338; NMERDI-2-72-4523) Avail: NTIS HC A99/MF A01

This manual contains extensive solar and weather data for the state of New Mexico in tabular, map, and graphic formats. It is particularly relevant to design of energy efficient buildings and renewable energy systems, but is also broad enough to provide useful information to many other disciplines. Maps of the state show monthly values of insolation for horizontal, south-facing latitude-tilted and vertical surfaces, as well as mean temperatures. Climatic summaries given for 63 sites include monthly temperature and precipitation data as well as heating/cooling degree-days and design temperatures. For nine locations (Albuquerque, Clayton, Farmington, Los Alamos, Roswell, T or C, Tucumcari, Zuni, and El Paso, Texas) most of the following comprehensive data sets are also presented: design temperatures with mean coincident wet bulb and wind values; HDD/CDD values to 12 base temperatures; day/night wind data; typical and clear-day values of incident and transmitted solar radiation for 97 orientations and tilts; and temperature distribution data in 2°F bins for six daily time periods. Extensive explanatory text with referencing to the data is provided. DOE

N86-28582# Ifremer, Paris (France).

STUDY OF THE ALGORITHM TO ESTIMATE FRICTION VELOCITY AT THE SEA SURFACE [ETUDE DE LALGORITHME DESTIMATION DE LA VITESSE DE FROTTENMENT A LA SURFACE DE LA MER]

Robert Ezraty Paris ESA 1986 57 p In FRENCH
(Contracts ESTEC-6155/85-NL-BI; IFREMER-85.2.42.5000)
(ESA-CR(P)-2169; ESA-86-96868) Avail: NTIS HC A04/MF A01

The theoretical and experimental basis to model the atmospheric boundary layer over the ocean from velocity and temperature measurements of air and water is presented. A computer program derived from these notions is used to study the variations of velocity profiles for different roughness levels. Several formula-

tions of the roughness magnitude are compared and their influence on the determination of friction velocity and the 10 m neutral equivalent velocity is estimated. It is deduced that the 10 m neutral velocity is practically independant of the model choice. ESA

N86-28583# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Wolkenphysik.

DETERMINATION OF ATMOSPHERIC PARAMETERS BY AN AIRBORNE BACKSCATTER PROBE

Hans-Eberhard Hoffmann Oct. 1985 69 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-990)

(DFVLR-FB-85-61; ISSN-0171-1342; ESA-86-96881) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 23

Measurements performed with a backscatter probe on an icing research aircraft are discussed. This probe transmits the white light of a flashlight. The backscattered light is received in three different wavelength ranges. The backscattered signals were calibrated for measuring standard visibilities outside clouds by an integrating nephelometer, and for measuring standard visibilities in clouds by contrast measurements. Information on particle size distributions is obtained from the values of the backscattered signal if the liquid water content is measured synchronously. Solid particles differ from fluid particles by amplitude and type of backscattered signal. Examples of measurement results are shown. ESA

N86-28584# Royal Netherlands Meteorological Inst., De Bilt. Afdel. Fysisch Meteorologisch Onderzoek.

DESCRIPTION OF THE IJMUIDEN (NETHERLANDS) WIND OBSERVATION STATION FOR THE PERIOD 1919-1980 [STATIONSBESCHRIJVING WINDWAARNEMING IJMUIDEN PERIODE 1919-1980]

B. Oemraw 1985 60 p In DUTCH; ENGLISH summary

(KNMI-TR-73; B8576433; ISSN-0169-1708; ESA-86-96957) Avail: NTIS HC A04/MF A01

At Ijmuiden (Netherlands) wind was observed from 1919 to 1968 above land and 1968 to 1980 above the North Sea, 1km from the shore. Locations of anemometers are described. Specifications of wind meter types and recorders used are given. The wind data obtained are (after objective correction for sheltering effects from the surroundings) reasonably dependable and homogenous from April 1952 to 1980. Corrected wind data summaries for 1953 to 1967 (above open terrain) and during 1969 to 1980 (above open water) are given. The tables cover the diurnal and annual course, frequency distributions, and for each two month period the maximum values of the hourly-average wind speed per 30 deg azimuth sector. ESA

N86-28585# Stockholm Univ. (Sweden). Dept. of Meteorology.

A CONSISTENT SCHEME FOR TREATMENT OF STRATIFORM AND CONVECTIVE CONDENSATION AND CLOUDINESS IN NUMERICAL WEATHER PREDICTION MODELS

Ulla Hammarstrand and Hilding Sundqvist (Bergen Univ., Norway) 13 Jan. 1986 31 p

(Grants G-GU-8494-100; G-GU-8494-101)

(DM-47; ISSN-0349-0467; ESA-86-97059) Avail: NTIS HC A03/MF A01

A parameterization scheme for stratiform and convective condensation with cloud water content and cloud cover as dependent variables is implemented in a limited area model for weather prediction. The parameterization comprises microphysical processes and subgrid scale features. The scheme for stratiform clouds is based on Sundqvist (1981). The scheme for the convective clouds is based on Kuo (1974) and Hammarstrand (1982). Aspects regarding the necessary combination of the schemes in connection with transition between the two stability regimes are discussed. Results from two 36 hr predictions started 12 hr apart are evaluated with regard to sensitivity to initial data. ESA

N86-28586# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.

COSMIC RAY NM-64 NEUTRON MONITOR DATA 12, JANUARY-DECEMBER 1983

N. Iucci, F. Re, F. Signoretti, C. Signorini, G. Villoresi, and N. L. Zangrilli May 1985 55 p Prepared in cooperation with Rome Univ. (Italy)

(IFSI-85-6; ESA-86-97090) Avail: NTIS HC A04/MF A01

Pressure corrected data from the Rome neutron monitor and barometric pressure data for the year 1983, and graphs of the corrected intensity are given. Details on the devices employed, operational mode, and data handling are presented. ESA

N86-28587# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.

COSMIC RAY NM-64 NEUTRON MONITOR DATA 12, JANUARY-DECEMBER 1984

N. Iucci, R. Beccellato, F. Re, F. Signoretti, C. Signorini, G. Villoresi, and N. L. Zangrilli Oct. 1985 55 p

(IFSI-85-13; ESA-86-97097) Avail: NTIS HC A04/MF A01

Pressure corrected data from the Rome neutron monitor and barometric pressure data, for the year 1984, and graphs of the corrected intensity are given. Details on the devices employed, operational mode, and data handling are presented. ESA

N86-28588# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

PROCESSING AND METEOROLOGICAL EVALUATION OF RESEARCH FLIGHTS WITH DFVLR MOTOR GLIDERS USING THE SOFTWARE PACKAGE RAMF

Joerg M. Hacker Jan. 1985 69 p In GERMAN; ENGLISH summary

(DFVLR-FB-85-57; ISSN-0171-1342; ESA-86-96877) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 19

The procedures developed for the processing and simple meteorological reduction of data from measuring flights are summarized. Philosophy, construction, and utilization of the software package RAM (routines for the evaluation of meteorological research flights) are described. The routines and the methods for data evaluation are presented and clarified by examples. The accuracy of the derived variables is estimated. ESA

N86-28589# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Resources Research.

PHYSICS OF WINTER OROGRAPHIC PRECIPITATION AND ITS MODIFICATION: SUMMARY OF WORKSHOP PRESENTATIONS

A. B. Super Jan. 1986 99 p Workshop held at Denver, Colorado, 1-3 Oct. 1985

(PB86-174299) Avail: NTIS HC A05/MF A01 CSCL 04B

Recent findings from the Sierra cooperative pilot project are discussed. The physics of dispersion and transport; ice multiplication; recent results of an orographic seeding experiment; recent findings from the Colorado River augmentation demonstration program; recent findings from the Bridger Range, Montana; and recent findings from the State of Utah are discussed. Winter weather modification research at Utah State University; and microphysical characteristics of winter clouds in Alberta are also discussed. GRA

N86-28590# National Weather Service, Kansas City, Mo.

SOME CHARACTERISTICS OF NORTHEAST KANSAS SEVERE WEATHER 1963-1984

L. W. Schultz Mar. 1985 17 p

(PB86-173952; NOAA-TM-NWS-CR-80) Avail: NTIS HC A02/MF A01 CSCL 04B

Severe weather events occurring in northeast Kansas were examined for the period 1963 through 1984. From these reports, general characteristics of severe weather in northeast Kansas have been determined. Because of its geographical location, the state of Kansas is frequently subject to severe convective weather in the spring and summer. One of these was the June 8, 1966 tornado which cut a swath of destruction from southwest to

northeast across the heart of Topeka and killed 17 persons. Though much smaller in size and intensity, another storm occurred the evening of June 17, 1978. Because of the frequency of severe convective weather in Kansas, the paper will focus on severe convective weather in northeast Kansas. Author

N86-28591# National Weather Service, Salt Lake City, Utah.
SOARING FORECAST PROGRAM (REVISED)
D. S. Toronto and G. R. Lussky Mar. 1986 13 p
(PB86-173523; NOAA-NWS-WRCP-36-Rev) Avail: NTIS HC A02/MF A01 CSCL 04B

Soaring is becoming an increasingly popular sport in many regions of the United States, particularly in the Western Region where the atmospheric conditions tend to be very favorable for soaring during much of the warm season. Because of the importance of the vertical temperature structure and wind conditions with regard to soaring, program SR was written as an aid for the participant. The program has been made universal so that any location may run it without requiring program changes and recompilation. The program is written in Data General FORTRAN IV. GRA

N86-28592# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
REVIEW OF THE VAS (VISIBLE AND INFRARED SPIN-SCAN RADIOMETER ATMOSPHERIC SOUNDER) ASSESSMENT DURING THE 1985 PROFS (PROGRAM FOR REGIONAL AND OBSERVING FORECASTING SERVICES) SUMMER EXERCISE
D. Birkenheuer and J. Snook Oct. 1985 86 p
(PB86-173309; NOAA-TM-ERL-ESG-19) Avail: NTIS HC A05/MF A01 CSCL 04B

An operational Visible and Infrared Spin-Scan Radiometer Atmospheric Sounder (VAS) assessment was conducted as part of the Program for Regional and Observing Forecasting Services (PROFS) 1985 summer forecasting exercise from 15 May through 23 August. The exercise focused on nowcasting severe weather, specifically the issuance of watches and warnings for a 150 km area surrounding Boulder, Colorado. GRA

N86-28593# National Weather Service, Salt Lake City, Utah.
MCC (MESOSCALE CONVECTIVE COMPLEXES): AN OVERVIEW AND CASE STUDY ON ITS IMPACT IN THE WESTERN UNITED STATES
G. R. Lussky Mar. 1986 55 p
(PB86-170651; NOAA-TM-NWS-WR-193) Avail: NTIS HC A04/MF A01 CSCL 04B

Severe weather - as defined by tornadoes, large hail and strong thunderstorm winds - is more uncommon in the Western Region than it is in the other National Weather Service regions. While thunderstorms do occur throughout much of the region from time to time, they are generally less intense in nature than many of those that occur over the central United States. This has recently been demonstrated by Schaefer, et al. (1985) using tornado statistics which show that the areal frequency of all tornadoes drops, in general, from one to three orders of magnitude from the central U.S. to the western U.S. The biggest difference in the tornado statistics, however, is in the magnitude of the storm (i.e., it's width and path length). The areal frequency of severe weather over the West drops off sharply when only the intense storms are included; the dropoff is less dramatic over the central states. This suggests that not only are there more tornadic storms over the central U.S., but they are also more intense. Author

N86-28594# National Bureau of Standards, Gaithersburg, Md. Center for Building Technology.
DIRECTIONAL HURRICANE WIND SPEEDS Final Report
E. M. Hendrickson and E. Simiu Feb. 1986 34 p
(PB86-169026; NBSIR-86/3317) Avail: NTIS HC A03/MF A01 CSCL 04B

A simple procedure for estimating coastline hurricane wind speeds corresponding to any specified set of wind directions and to any specified mean recurrence interval is presented. The procedure uses simulated directional hurricane wind speed data as described in the report, Hurrican Wind Speeds in the United States (NBS BSS 124). These data are encoded on magnetic tape for 56 mileposts located along the U.S. Gulf and Atlantic coasts. GRA

N86-28595# National Center for Atmospheric Research, Boulder, Colo.
USER GUIDE TO A PARTICLE-GROWTH AND TRAJECTORY MODEL (USING ONE-DIMENSIONAL AND THREE-DIMENSIONAL WIND FIELDS)
J. L. Parrish and A. J. Heymsfield Oct. 1985 88 p
(Grant NSF ATM-82-17015)
(PB86-168010; NCAR/TN-259+1A) Avail: NTIS HC A05/MF A01 CSCL 04B

In the process of studying the growth of hail and other precipitation forms within wind fields derived from Doppler radar analyses, the authors have developed GROW, a particle growth model. Forms of ice precipitation are diverse, and the schemes for the detailed growth calculations are lengthy and complex. The attempt has been to be as complete and up-to-date as possible with regard to ice growth processes by accretion and diffusion, with special attention to the complex temperature dependencies and the difficult specification of density, terminal velocity, melting and shedding, and collection efficiency. Less elaborate treatments of aggregation and liquid coalescence are included. The growth model is combined with either a one-dimensional dynamic and thermodynamic model, with conventional lateral entrainment (1D), or a three-dimensional wind field, as may be obtained from a Doppler radar field study or a dynamical model. GRA

N86-28596# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
COMPARISON OF DOPPLER LIDAR, RAWINSONDE AND 915-MHz UHF WIND PROFILER MEASUREMENTS OF TROPOSPHERIC WINDS
T. R. Lawrence, B. F. Weber, M. J. Post, R. M. Hardesty, and R. A. Richter Jan. 1986 89 p
(PB86-166220; NOAA-TM-ERL-WPL-130) Avail: NTIS HC A05/MF A01 CSCL 04B

Tropospheric wind-field measurements obtained using a Doppler lidar are compared against rawinsonde observations and the measurements of a 915-MHz UHF wind Profiler. Height-averaged values of lidar-minus-rawinsonde mean (median) difference, and root-mean-square difference between lidar and rawinsonde horizontal wind-field measurements are respectively -1.79 (-1.46), 3.31 m/s for wind speed and -0.09 degrees (-0.54 degrees), 12.13 degrees for wind direction. These estimates are based on 429 data pairs. Author

N86-28597# Electronic Techniques, Inc., Fort Collins, Colo.
SCPP (SIERRA COOPERATIVE PILOT PROJECT) METEOROLOGICAL AND STATISTICAL SUPPORT, VOLUME 1 Interim Progress Report, 1 Sep. 1984 - 31 Aug. 1985
A. W. Huggins, J. O. Rhea, G. L. Hemmer, A. P. Kuciauskas, and C. J. Wilcox Oct. 1985 250 p Sponsored by Bureau of Reclamation
(PB86-189404) Avail: NTIS HC A11/MF A01 CSCL 04B

Field operations and data collection procedures for the Sierra Cooperative Pilot Project (SCPP) forecast office, radar and rawinsondes are described. A series of analyses by ETI and NAWC scientists is presented. Seeding effects in radar data are described for convective clouds seeded with CO2 and AgI. The passage of certain radar echoes was found to be associated with lowering cloud top and an increase in supercooled liquid water (SLW) at Kingvale. In conjunction with satellite data such correspondence may be used to help predict the occurrence of clouds suitable for seeding experiments. GRA

N86-28598# Electronic Techniques, Inc., Fort Collins, Colo.
SCPP (SIERRA COOPERATIVE PILOT PROJECT) METEOROLOGICAL AND STATISTICAL SUPPORT, VOLUME 2 Interim Progress Report, 1 Sep. 1984 - 31 Aug. 1985
G. L. Hemmer, A. W. Huggins, A. P. Kuciauskas, and C. J. Wilcox

Oct. 1985 212 p Sponsored by Bureau of Reclamation
(PB86-189412) Avail: NTIS HC A10/MF A01 CSCL 04B

Field operations and data collection procedures for the Sierra Cooperative Pilot Project (SCPP) forecast office, radar and rawinsondes are described. A series of analyses by ETI and NAWC scientists is presented. Seeding effects in radar data are described for convective clouds seeded with CO2 and AgI. The passage of certain radar echoes was found to be associated with lowering cloud top and an increase in supercooled liquid water (SLW) at Kingvale. In conjunction with satellite data such correspondence may be used to help predict the occurrence of clouds suitable for seeding experiments. One detailed case study revealed a situation where SLW was plentiful in a region upwind of the crest, but was negligible near the crest because of depletion by secondary ice crystal production. GRA

N86-28599# Sonoma Technology, Inc., Santa Rosa, Calif.
FOG SAMPLER INTERCOMPARISON STUDY Final Report
S. V. Hering and D. L. Blumenthal Oct. 1985 172 p Sponsored by Coordinating Research Council
(PB86-186616; STI-11-90063-308-FR;
CRC-APRAC-CAPA-21-80-05) Avail: NTIS HC A08/MF A01 CSCL 04B

Fog samplers of five different designs were operated simultaneously to assess differences, if any, in acidity, and to analyze concentrations and liquid water collection efficiencies. Measurements were made at Henninger Flats, a mountainous site at 777 m msl overlooking the Los Angeles, California, basin. Sampling was conducted in June 1983 when status clous intercepted the measurements sites. Five different types of fog samplers were operated by the groups which designed them. GRA

N86-28600# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MID-APRIL TO MID-MAY 1986, VOLUME 40, NUMBER 8, APRIL 15, 1986
15 Apr. 1986 10 p
(PB86-185501) Avail: NTIS HC A02/MF A01 CSCL 04B

Temperature and precipitation probabilities for the monthly and seasonal weather for North America are given. GRA

N86-28601# National Weather Service, Salt Lake City, Utah.
HEMISPHERIC SPECTRAL ANALYSIS PROGRAM
C. C. Peterson Apr. 1986 35 p
(PB86-183662; NOAA-NWS-WRCP-54) Avail: NTIS HC A03/MF A01 CSCL 04B

The hemispheric atmospheric kinetic energy spectrum can often give clues to the present large scale state of the atmosphere as well as to future states. The program HEMI calculates this spectrum. Much research has been done recently on the relationship between tropical and subtropical forcings and global circulaton anomalies. Of significant interest to forecasters, the northern hemisphere mid-latitudes often exhibit an organized response to the forcings, in the form of wave train anomalies in the geopotential height field (Weickmann, et al. 1985). The program HEMI calculates the kinetic energy spectrum for wavenumbers 1 through 7. GRA

N86-28602# National Weather Service, Salt Lake City, Utah.
RADID (RADAR DISPLAY DEVICE) INTERPRETATION GUIDELINES
R. G. Pappas Mar. 1986 35 p
(PB86-177680; NOAA-TM-NWS-WR-195) Avail: NTIS HC A03/MF A01 CSCL 04B

Interpretative guidelines for users of radar remoting systems are given. The focus is upon the benefits and inherent limitations of this approach to weather radar data communication and display, and radar interpretation, particularly unique problems in the Western United States. This set of guidelines applies principally to Radar Display Device (RADID) displays but will also be useful for Radar Remote Weather Display System (RRWDS) and commercial color radar remote users. RRWDS consists of two primary components - a digitizer on a radar for generating VIP-level data and a display system which includes a separate processor. RADID is a display device only. RADID can access data from RRWDS and commercial digitizers. RRWDS displays can only access data from RRWDS digitizers. GRA

N86-28853# Imperial Coll. of Science and Technology, London (England). Center for Remote Sensing and Atmospheric Physics
THE METEOROLOGY OF SATURN
Garry E. Hunt *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 33-40 Sponsored by UK Science and Engineering Research Council (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28857# Arizona Univ., Tucson. Lunar and Planetary Lab.
LIGHTNING ON SATURN
Donald M. Hunten *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 69-71 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-28603# Defence Research Information Centre, Orpington (England).
ON THE RECOGNITION OF OCEANIC MOTION IN SATELLITE INFRARED AND RADAR ALTIMETER DATA
Paul Gerhard Hardtke Oct. 1985 18 p Transl. into ENGLISH of Z. fuer Flugwiss. u. Weltraumforsch., v. 98, no. 5, 1984 p 359-364
(DRIC-T-7597; BR97665; ESA-86-97135) Avail: Issuing Activity

Data from NOAA 6 and 7 showing variation of sea surface temperature in the North Atlantic are presented. These, together with radar altimeter measurements, are used to determine ocean surface currents. ESA

N86-28604# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
MEASUREMENTS OF INTERNAL WAVES IN THE STRAIT OF GIBRALTAR USING A SHORE-BASED RADAR Final Report
Paul E. LaViolette, Thomas H. Kinder, and Dove W. Green, III Jan. 1986 15 p
(AD-A165715; NORDA-118) Avail: NTIS HC A02/MF A01 CSCL 17/9

During the period 22 to 24 October 1983, a feasibility study was made on the use of standard shore radars to monitor the temporal and spatial distribution of internal waves. A radar (150 m elevation) situated at Gibraltar was used to monitor the surface manifestations of internal waves in the Strait of Gibraltar during three semidiurnal tidal periods. The eastward progression of internal waves within an arc approximately 19 km from the radar was observed. These observations fill a gap in the evolution of the surface signatures of internal waves between the small-scale view of ship radars and the large-scale view afforded by satellites and the Space Shuttle. Author (GRA)

N86-28605# European Space Agency, Paris (France).
LASER DOPPLER WIND PROFILE MEASUREMENTS OVER SEA SURFACES
Christian Werner, Friedrich Koepp, Eugen Biselli, and Elfriede Biselli Jan. 1986 57 p Transl. into ENGLISH from "Laser-Doppler-Windprofil-Messungen ueber See" Oberpfaffenhofen, West Germany Original report in GERMAN previously announced as ESA-96606
(ESA-TT-971; DFVLR-FB-85-48; ESA-86-95748) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne DM 18

A laser Doppler anemometer on a research platform determined the wind profile above the surface of the North Sea. The measured profiles show nearly constant wind velocities between the sea surface and 100 m height. No logarithmic wind profile was measured. The influence of the platform on the measurements

was determined. The influence of the tidal movement was corrected. The laser Doppler anemometer is the only measuring system which allows the simultaneous measurement of wind and water surface velocity. The turbulence was also measured. ESA

N86-28492# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SEA ICE PARAMETER RETRIEVAL FROM SAR DATA
H. Skriver and P. Gudmandsen *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data Dec. 1985 p 21-28 (For primary document see N86-28488 19-42)
Avail: NTIS HC A06/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-28606*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
US MONKEY AND RAT EXPERIMENTS FLOWN ON THE SOVIET SATELLITE COSMOS 1514
Richard C. Mains, ed. and Edward W. Gomersall, ed. May 1986 284 p
(NASA-TM-88223; A-86147; NAS 1.15:88223) Avail: NTIS HC A13/MF A01 CSCL 06C

On December 14, 1983, the U.S.S.R. launched Cosmos 1514, an unmanned spacecraft carrying biological and radiation physics experiments from nine countries, including five from the United States. This was the fourth flight with U.S. experiments aboard one of the Soviet unmanned spacecraft. The Cosmos 1514 flight was limited to five days duration because it was the first non-human primate flight. Cosmos 1514 marked a significant departure from earlier flights both in terms of Soviet goals and the degree of cooperation between the U.S.S.R. and the United States. This flight included more than 60 experiments on fish, crawfish eggs, plants and seeds, 10 Wistar pregnant rats, and 2 young adult rhesus monkeys as human surrogates. United States specialist participated in postflight data transfer and specimen transfer, and conducted rat neonatal behavioral studies. An overview of the mission is presented focusing on preflight, on-orbit, and postflight activites pertinent to the five U.S. experiments aboard Cosmos.
Author

N86-28607# Pittsburgh Univ., Pa.
ENZYME COFACTOR MODIFIED ELECTRODES Final Report, 8 Feb. 1982 - 31 Dec. 1985
Lemuel B. Wingard, Jr. 19 Feb. 1986 6 p
(Contract DAAG29-82-K-0064)
(AD-A165604; ARO-18310.16-CH) Avail: NTIS HC A02/MF A01 CSCL 07/4

This work was focused on the study of flavin cofactor enzymes for the development of improved oxidation-reduction enzyme electrodes for eventual use in biosensors or other electrochemical systems. Flavin adenine dinucleotide or glucose oxidase were immobilized on different types of carbon electrodes and tested for electrochemical and enzymatic activity. Diffusional studies also were carried out to determine the diffusional resistance of the immobilization matrix. GRA

N86-28608# Letterman Army Inst. of Research, San Francisco, Calif.
ACUTE ORAL TOXICITY (LD50) OF GUANIDINE HYDROCHLORIDE IN RATS Final Report, 19 Jan. - 14 Feb. 1984
Earl W. Morgan, Steven K. Sano, and Don W. Korte, Jr. Aug. 1985 105 p
(AD-A165747; LAIR-204; TOXICOLOGY-SER-77) Avail: NTIS HC A06/MF A01 CSCL 06/20

Nitroguanidine is being evaluated by the US Army as a replacement for the nitrocellulose component of certain propellants/munitions. One of the by-products to be tested is guanidine. The hydrochloride salt was used in this evaluation of the acute toxicity of guanidine. The acute oral toxicity of guanidine hydrochloride was determined in male and female Sprague-Dawley rats by using the oral gavage single-dose method. The LD50 + or - S.E. for male rats was 556.5 + or - 29.7 mg(base)/kg and 474.6 + or - 35.3 mg(base)/kg for female rats. Clinical signs were observed in both the gastrointestinal (GI) tract and the central nervous system-neuromuscular junction (CNS-NM). Symptoms referrable to the GI tract included increased salivation, hunched posture, and diarrhea. CNS-NM signs included disorientation, increased startle reflex, hyperactivity, jumping behavior, presence of tremors/twitching and depression of grasping and righting reflexes. These results place guanidine hydrochloride in slightly toxic and moderately toxic ranges respectively. GRA

N86-28609# California Inst. of Tech., Pasadena. Div. of Biology.
INFORMATION PROCESSING IN MAMMALIAN VISUAL CORTEX Interim Report, 1 Dec. 1984 - 30 Nov. 1985
David C. VanEssen 26 Feb. 1986 26 p
(Contract N00014-85-K-0068)
(AD-A165832) Avail: NTIS HC A03/MF A01 CSCL 06/16

This report used a combination of physiological and anatomical approaches to elucidate the functional organization of the visual cortex in the macaque monkey. One project was a single cell analysis of texture vision, using texture patterns of the type developed by Julesz for human psychophysical studies. Many cells tested in area V2 responded to static or moving texture gradients in ways which were not predictable on the basis of responses to individual texture elements and which correlated with the preattentive discriminability of these texture patterns to human observers. A second project involved the development of a computerized technique for generating two-dimensional maps of cerebral cortex. An algorithm based on simulated annealing procedures was used to construct a complete map of primary visual cortex, thereby demonstrating its suitability for dealing with anatomical data from highly convoluted regions of cortex. A third project involved the use of voltage-sensitive dyes to monitor activity patterns in visual cortex. This technique offers great promise for analyzing the organization of large neural ensembles with high spatial and temporal resolution. GRA

N86-28610# Joint Publications Research Service, Arlington, Va.
USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES
19 May 1986 106 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-86-009) Avail: NTIS HC A06/MF A01

Progress is reported in U.S.S.R. biomedical and behavioral sciences. Topics discussed include: agrotechnology; biophysics; biotechnology; ecology; environment; epidemiology; food technology; genetics; immunology; laser effects; marine mammals; medicine; microbiology; molecular biology; niemr; pharmacology and toxicology; physiology; public health; and psychiatry. For individual titles, see N86-28611 through N86-28611.

N86-28611# Joint Publications Research Service, Arlington, Va.
RESISTANCE, EXCHANGE, AND CAPACITANCE FUNCTIONS OF SKELETAL MUSCLE VESSELS IN ACUTE HYPOXIC HYPOXIA **c52**
B. I. Tkachenko and Yu. I. Ibragimov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-009) 19 May 1986 p 71-72 Transl. into ENGLISH from Fiziologicheskiy Zhurnal SSSR (Leningrad, USSR), v. 81, no. 10, Oct. 1985 p 1229-1237 (For primary document see N86-28610 19-51)
Avail: NTIS HC A06/MF A01

It is shown that acute hypoxia (10 percent O2 in nitrogen) increases precapillary resistance of skeletal muscle vessels in hemodynamically isolated cats. Postcapillary resistance was reduced by about 30 percent together with capillary hydrostatic pressure and the capillary filtration coefficient (CFC). Similar changes were observed in the denervated vascular bed under cross circulation. B.W.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-28612* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 286)
Jul. 1986 77 p
(NASA-SP-7011(286); NAS 1.21:7011(286)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 213 reports, articles and other documents introduced into the NASA scientific and technical information system in June 1986. Author

N86-28613*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CREW FACTORS IN FLIGHT OPERATIONS. PART 4: SLEEP AND WAKEFULNESS IN INTERNATIONAL AIRCREWS
R. Curtis Graeber Feb. 1986 113 p
(Contract NCC2-302)
(NASA-TM-88231; A-86182; NAS 1.15:88231) Avail: NTIS HC A06/MF A01 CSCL 06P

Physiological recordings of sleep and wakefulness in operating international (B-747) flight crews were obtained. Crews spent their first layover (48 h) of a trip in a sleep laboratory where standardized EEG, electro-oculograph (EOC), and electromyograph (EMG) sleep recordings were carried out whenever volunteers chose to sleep. During periods of wakefulness they underwent multiple sleep latency tests every 2 h in order to assess daytime drowsiness. The same standardized recordings were carried out at a home-based laboratory before departure. Approximately four crews each participated in flights over 7 to 9 time zones on five routes. All participants were encouraged to use whatever sleep-wake strategies they thought would provide them with the most satisfactory crew rest. Overall, layover sleep quality was not seriously disturbed, but eastward flights produced greater sleep disruption. The contributors of individual factors and the usefulness of various sleep strategies are discussed in the individual laboratory reports and in an operational summary. Author

N86-28614# Armed Forces Radiobiology Research Inst., Bethesda, Md.
AFRRI (ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE) Annual Research Report, 1 Oct. 1984 - 30 Sep. 1985
30 Sep. 1985 101 p
(AD-A165810; AFRRI-ARR-19) Avail: NTIS HC A06/MF A01 CSCL 06/18

The Armed Forces Radiobiology Research Inst.(AFRRI) is the primary DOD facility for scientific research in the field of radiobiology and related matters. It conducts applied and basic research that is essential for the operational and medical support of the DOD. The work carried out by its five scientific departments is noted. Operation, maintenance, and quality control of all AFFRI radiation sources, radiation dosimetry and estimation of tissue doses at various depths in different kinds if tissues; development and use of nuclear medicine and magnetic spectroscopic techniques for determining radiation damage in animals and model systems. GRA

N86-28615# Health Effects Research Lab., Research Triangle Park, N. C.
APPLICATION OF PORTABLE MICROPROCESSOR-BASED SYSTEM FOR ELECTROPHYSIOLOGICAL FIELD TESTING OF NEUROTOXICITY
D. Otto, S. Baumann, and G. Robinson Jan. 1986 19 p refs Prepared in cooperation with Illinois Univ., Urbana-Champaign and North Carolina Univ., Chapel Hill
(PB86-145471; EPA-600/D-86-008) Avail: NTIS HC A02/MF A01 CSCL 06T

A portable microprocessor based system designated PEARL II was developed for neurotoxicity testing in human populations. PEARL II provides a flexible and powerful data acquisition capability to record sensory evoked potentials (auditory, visual, and somatosensory), event related slow potentials (CNV, P300), and behavioral measures. PEARL II was mounted in a mobile laboratory to facilitate field testing. Data obtained in pediatric lead studies are provided for illustration. GRA

N86-28611# Joint Publications Research Service, Arlington, Va.
RESISTANCE, EXCHANGE, AND CAPACITANCE FUNCTIONS OF SKELETAL MUSCLE VESSELS IN ACUTE HYPOXIC HYPOXIA
B. I. Tkachenko and Yu. I. Ibragimov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-009) 19 May 1986 p 71-72 Transl. into ENGLISH from Fiziologicheskiy Zhurnal SSSR (Leningrad, USSR), v. 81, no. 10, Oct. 1985 p 1229-1237 (For primary document see N86-28610 19-51)
Avail: NTIS HC A06/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-28616# California Univ., Santa Barbara.
COMPONENTS OF SPATIAL ABILITY Final Report, Jun. 1981 - Sep. 1984
James W. Pellegrino, David L. Alderton, and J. W. Regian 24 Mar. 1986 68 p
(Contracts N00014-81-C-0616; NR Proj. RR0-4204)
(AD-A165694) Avail: NTIS HC A04/MF A01 CSCL 05/10

The goal of this project was to identify information processing components of spatial ability. A summary paper is presented that reviews major psychometric analyses of spatial ability as they relate to theories of information processing. The primary emphasis in the review is of studies isolating individual differences in components of spatial information processing. Research is also reviewed on the acquisition of spatial processing skills. The final section considers implications of this line of research for issues of assessment, particularly as it relates to modern technologies for testing. GRA

N86-28617# Wisconsin Univ., Madison. Center for Education Research.
INEXPERT CALIBRATION OF COMPREHENSION Technical Report, Sep. - Dec. 1985
Arthur M. Glenberg and William Epstein 1 Mar. 1986 48 p
(Contracts N00014-85-K-0644; NR Proj. RR0-4206)
(AD-A165701; WCER-86-3) Avail: NTIS HC A03/MF A01 CSCL 05/10

Students with a wide range of coursework in physics or music theory read expositions in both domains. After reading, for each text students provided a judgment of confidence in ability to verify inferences based the central principle of the text. The primary dependent variable was calibration of comprehension, the degree of association between confidence and performance in the inference test. Two results of most interest were expertise in a domain was inversely related to calibration and subjects were well-calibrated across domains. Both of these results can be accommodated by a self-classification strategy: Confidence judgments are based on self-classification as expert or non-expert in the domain of the text, rather than an assessment of the degree to which the text was comprehended. Because self-classifications are not well differentiated within a domain, application of the strategy by experts produces poor calibration within a domain. Nonetheless, because self-classification is generally consistent with performance across domains, application of the strategy produces calibration across domains. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-28618* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TORSO SIZING RING CONSTRUCTION FOR HARD SPACE SUIT Patent
Hubert C. Vykukal Issued 10 Jun. 1986 9 p Filed 20 Dec. 1984 Supersedes N85-21987 (23 - 12, p 1910)
(NASA-Case-ARC-11616-1; US-Patent-4,593,415;
US-Patent-Appl-SN-684193; US-Patent-Class-2-2.1A;
US-Patent-Class-2-2.1R; US-Patent-Class-128-202.11;
US-Patent-Class-414-1; US-Patent-Class-414-5;
US-Patent-Class-414-7; US-Patent-Class-414-8) Avail: US Patent and Trademark Office CSCL 06Q

A hard suit for use in space or diving applications having an adjustable length torso covering that will fit a large variety of wearers is described. The torso covering comprises an upper section and a lower section which interconnect so that the covering will fit wearers with short torsos. One or more sizing rings may be inserted between the upper and lower sections to accomodate larger torso sizes as required. Since access of the astronaut to the torso covering is preferably through an opening in the back of the upper section (which is closed off by the backpack), the rings slant upward-forward from the lower edge of the opening. The lower edge of the upper covering section has a coupler which slants upward-forward from the lower edge of the back opening. The lower torso section has a similarly slanted coupler which may interfit with the upper section coupler to accomodate the smallest torso size. One or more sizing rings may be inserted between the coupler sections of the upper and lower torso sections to accomodate larger torsos. Each ring has an upper coupler which may interfit with the upper section coupler and a lower coupler which may interfit with the lower section coupler. NASA

N86-28619* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELBOW AND KNEE JOINT FOR HARD SPACE SUITS Patent
Hubert C. Vykukal Issued 8 Jul. 1986 13 p Filed 30 Dec. 1984 Supersedes N85-20666 (23 - 11, p 1697)
(NASA-Case-ARC-11610-1; US-Patent-4,598,427;
US-Patent-Appl-SN-684190; US-Patent-Class-2-2.1A;
US-Patent-Class-2-2.1R; US-Patent-Class-285-168;
US-Patent-Class-138-120) Avail: US Patent and Trademark Office CSCL 06Q

An elbow or knee joint for a hard space suit or similar usage is formed of three serially connected rigid sections which have truncated spherical configurations. The ends of each section form solid geometric angles, and the sections are interconnected by hermetically sealed ball bearings. The outer two sections are fixed together for rotation in a direction opposite to rotation of the center section. A preferred means to make the outer sections track each other in rotation comprises a rotatable continuous bead chain which engages sockets circumferentially spaced on the facing sides of the outer races of the bearings. The joint has a single pivot point and the bearing axes are always contained in a single plane for any articulation of the joint. Thus flexure of the joint simulates the coplanar flexure of the knee or elbow and is not susceptible to lockup. NASA

N86-28620* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHOULDER AND HIP JOINT FOR HARD SPACE SUITS Patent
Hubert C. Vykukal Issued 17 Jun. 1986 11 p Filed 20 Dec. 1984 Supersedes N85-21986 (23 - 12, p 1910)
(NASA-Case-ARC-11543-1; US-Patent-4,594,734;
US-Patent-Appl-SN-684192; US-Patent-Class-2-2.1A;
US-Patent-Class-414-7; US-Patent-Class-285-168;
US-Patent-Class-138-120) Avail: US Patent and Trademark Office CSCL 06Q

Shoulder and hip joints for hard space suits are disclosed which are comprised of three serially connected truncated spherical sections, the ends of which converge. Ball bearings between the sections permit relative rotation. The proximal end of the first section is connected to the torso covering by a ball bearing and the distal end of the outermost section is connected to the elbow or thigh covering by a ball bearing. The sections are equi-angular and this alleviates lockup, the condition where the distal end of the joint leaves the plane in which the user is attempting to flex. The axes of rotation of the bearings and the bearing mid planes are arranged to intersect in a particular manner that provides the joint with a minimum envelope. In one embodiment, the races of the bearing between the innermost section and the second section is partially within the inner race of the bearing between the torso and the innermost spherical section further to reduce bulk. NASA

N86-28621# Army Belvoir Research and Development Center, Fort Belvoir, Va.
DEVELOPMENT OF U.S. ARMY REVERSE OSMOSIS WATER PURIFICATION EQUIPMENT Final Report, 1950 - 1985
Don C. Lindsten Jan. 1986 76 p
(AD-A165667; BRDC-2418) Avail: NTIS HC A05/MF A01 CSCL 13/2

The United States Army has developed and field-tested a 600-gal/h Reverse Osmosis Water Purification Unit (ROWPU). In addition, it has procured a 150,000-gal/d ROWPU, and has under development a 3000-gal/h ROWPU. These units are capable of purifying raw water, seawater, brackish water, and water contaminated with nuclear, biological, and chemical (NBC) warfare agents. GRA

N86-28622# Armed Forces Food Science Establishment, Scottsdale (Australia).
EVALUATION OF WATER STERILIZING TABLETS
G. F. Thomson, K. W. James, G. E. Driver, and A. T. Hancock Aug. 1985 22 p
(AD-A165806; AFFSE-2/85) Avail: NTIS HC A02/MF A01 CSCL 13/2

Water sterilizing tablets were evaluated for their efficiency in killing micro-organisms. The effect of inhibitors and palatability were investigated. The effect of long term use is discussed. The water sterilizing tablet recommended for disinfection of personal drinking water is the Potable Aqua tablet. The Afses is not recommended because of its need for a quiescent period. The Puritabs is not recommended because of its inability to achieve the required 99.9% kill in heavily contaminated water, especially at alkaline pH values. Fortified beverage powders, which are effective detasting agents, will inactivate the disinfecting agent if added before completion of the recommended contact period. GRA

N86-28623# Lawrence Livermore National Lab., Calif.
SUIT PENETRATION STUDY: PRELIMINARY ANALYSIS OF FLOW ABOUT A CIRCULAR CYLINDER
R. C. McCallen and S. B. Sutton 27 Nov. 1985 28 p
(Contract W-7405-eng-48)
(DE86-005760; UCID-20636) Avail: NTIS HC A03/MF A01

The flow of atomized droplets around a circular cylinder (representing a human torso) is modeled. Two different computer codes have been used to generate solutions for the flow field: a finite difference code and a vertex method code. The finite difference code, CONCHAS-SPRAY (C-S), handles unsteady, viscous, compressible flow. The second code, KPD3, simulates unsteady, high Reynolds number, incompressible separated flow with an inviscid outer flow. The specific flow problem considered is described, followed by the results of a literature search for experimental data. DOE

N86-28291*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REVERSE OSMOSIS WATER PURIFICATION SYSTEM
H. G. Ahlstrom, P. S. Hames, and F. J. Menninger *In its* The Telecommunications and Data Acquisition Report 15 May 1986

10 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 06K

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

N86-28624*# National Aeronautics and Space Administration, Washington, D.C.
MODIFICATION OF CYTOGENETIC AND PHYSIOLOGICAL EFFECTS OF SPACE FLIGHT FACTORS BY BIOLOGICALLY ACTIVE COMPOUNDS
A. A. Aliyev, E. R. Mekhti-zade, A. L. Mashinskiy, and U. K. Alekperov Jul. 1986 14 p Transl. into ENGLISH from Zhurnal Obshchey Biologii (USSR), v. 47, no. 2, Mar. - Apr. 1986 p 246-251 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-87987; NAS 1.15:87987) Avail: NTIS HC A02/MF A01 CSCL 06C

Physiological and cytogenetic changes in the Welsh onion plants induced by a short (82 days) and long term (522 days) space flight are expressed in decrease of seed germination, inhibition of stem growth, depression of cell division in root meristem, and increase in the number of structural chromosome rearrangements. The treatment of such plants with solutions of a-tocopherol, auxin, and kinetin decreased the level of chromosome aberrations to the control one and normalized cell divisions and growth partly or completely. Author

N86-28625*# National Aeronautics and Space Administration, Washington, D.C.
MONKEYS AS A SOURCE OF VIRAL DISEASES IN MAN
E. R. Pille May 1986 14 p Transl. into ENGLISH from Voprosy Virusologii (USSR), v. 30, issue 2, Mar. - Apr. 1985 p 138-144 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-78017; NAS 1.15:78017) Avail: NTIS HC A02/MF A01 CSCL 06C

Under institutional scientific-research conditions, during contact with monkeys or their tissues, there is a danger of infection of the associates by simian viruses which are pathogenic to man. Presented in this paper is information on these stimulants. Author

N86-28626# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
APPLIED BIOLOGY AND BIOTECHNOLOGY, THE PROGRAM OF THE FEDERAL GOVERNMENT, 1985-1988 [ANGEWANDTE BIOLOGIE UND BIOTECHNOLOGIE PROGRAMM DER BUNDESREGIERUNG 1985-1988]
Oct. 1985 82 p In GERMAN Original contains color illustrations (ESA-86-96938) Avail: NTIS HC A05/MF A01

The program of the German Federal Government in the fields of applied biology is outlined. The measures taken by the government to intensify biotechnology basic research, and to provide research and economic conditions for an improved application of biotechnology are discussed. International cooperation in the domain is presented. The financial planning of the government for the stimulation of research in the fields of applied biology and biotechnology is presented. ESA

N86-28868# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Flugmedizin.
EXOBIOLOGICAL ASPECTS IN VIEW OF TITAN
G. Horneck *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 157-159 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28871# Centre National de la Recherche Scientifique, Orleans (France). Centre de Biophysique Moleculaire.
SEARCH FOR CHIRAL MOLECULES AND OPTICAL ACTIVITY IN EXTRATERRESTRIAL SYSTEMS. THE CASSINI MISSION OPPORTUNITY
Andre Brack and Gerard Spach (Rouen Univ. France) *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 189-191 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N86-28627*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AUTOMATIC PROBABILISTIC KNOWLEDGE ACQUISITION FROM DATA
William B. Gevarter Apr. 1986 30 p
(NASA-TM-88224; A-86154; NAS 1.15:88224) Avail: NTIS HC A03/MF A01 CSCL 12A

A computer program for extracting significant correlations of attributes from masses of data is outlined. This information can then be used to develop a knowledge base for a probabilistic expert system. The method determines the best estimate of joint probabilities of attributes from data put into contingency table form. A major output from the program is a general formula for calculating any probability relation associated with the data. These probability relations can be utilized to form IF-THEN rules with associated probability, useful for expert systems. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N86-28628*# National Aeronautics and Space Administration, Washington, D.C.
NASA SUPERCOMPUTER SYSTEM TO BECOME AVAILABLE NATIONALLY
Debra J. Rahn and Peter W. Wallter (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) 21 Jul. 1986 2 p
(NASA-News-Release-86-92; P86-10152) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8752, B.W.I. Airport, Md. 21240 CSCL 09B

The most powerful supercomputer facility in the world, the Numerical Aerodynamic Simulation (NAS) system, will go on-line to scientists and engineers throughout the country on July 21, 1986. The NAS supercomputer complex will be linked with 27 remote locations across the country through a combination of high-speed terrestrail and satellite links. The Cray-2 supercomputer was installed as the main computational engine. The NAS CRAY-2 has a 256 million word memory (largest yet available) and can perform 250 million computations a second. The next generation superfast computer currently referred to as the HSP-2 (High Speed Processor-2) is expected to perform a billion computation a second. This will bring the NAS system closer to its near-term goal of having computer with a billion word memory and computational power of 4 billion calculations a second. The NAS system will be relocated to a new computational facility in late 1986 and will be fully operational in March 1987. B.G.

N86-28358# Norwegian Defence Research Establishment, Kjeller.
TWO-LEVEL DATA-FLOW ARCHITECTURE FOR PROGRAMMABLE SIGNAL PROCESSING
Yngvar Lundh and Oddvar Sorasen *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 10 p (For primary document

see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28359# Royal Signals and Radar Establishment, Malvern (England).
MIL-DAP: ITS ARCHITECTURE AND ROLE AS A REAL TIME AIRBORNE DIGITAL SIGNAL PROCESSOR
P. Simpson, J. B. G. Roberts, and B. C. Merrifield *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 18 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28360# Tridex Systems, Inc., Nepean (Ontario).
A DISTRIBUTED ARRAY SIGNAL PROCESSOR WITH FAULT-TOLERANCE ATTRIBUTES
E. T. Fathi, C. V. W. Armstrong, K. Q. T. Nguyen, and A. W. Bridgewater (Department of Communications, Ottawa, Ontario) *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 15 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

N86-28364# British Aerospace Dynamics Group, Hatfield (England). Software Engineer.
THE IMPLEMENTATION OF IMAGE PROCESSING ALGORITHMS
D. A. Pellatt *In* AGARD The Impace of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 8 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-28629 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
A SURVEY OF EXTENSIONS IN PASCAL IMPLEMENTATIONS
D. A. Joslin and B. A. Wichmann Jan. 1986 22 p
(NPL-DITC-69/86; ISSN-0262-5369; ESA-86-97126) Copyright. Avail: Issuing Activity

Thirty-seven implementations of the Pascal programming language and their extensions considered for inclusion in an ISO standard are listed. ESA

N86-28630# Royal Signals and Radar Establishment, Malvern (England).
A PROCEDURAL IMPLEMENTATION OF PASCAL FILES ON FLEX
P. D. Hammond Jul. 1985 17 p
(AD-A163744; RSRE-MEMO-3883; BR98207; ESA-86-97118) Avail: Issuing Activity

Implementation of Pascal files in an object-oriented manner using procedure values is described. A Pascal compiler was written to the ISO standard for the Flex computer using these methods. Each file is represented by a package of procedures and every basic operation on the file is a call of one of these procedures. Such an implementation is only possible on a machine which supports true procedure values. These procedure values must be able to exist in the filestore as well as in the mainstore of the machine. ESA

N86-28631*# Software and Engineering Associates, Inc., Santa Ana Heights, Calif.
IMPROVED 2-DIMENSIONAL-KINETICS COMPUTER PROGRAM
Quarterly Progress Report, 1 Apr. - 30 Jun. 1984
Gary R. Nickerson Jul. 1984 36 p
(Contract NAS8-35931)
(NASA-CR-177243; NAS 1.26:177243; QPR-2) Avail: NTIS HC A03/MF A01 CSCL 09B

The analytical capability of the existing Two-Dimensional Kinetics (TDK)/Boundary Layer Module (BLM) computer program for performance of Orbit Transfer Vehicle (OTV) thrust chambers was examined. Areas which need further examination and improvement are the thick boundary layer inviscid core flow interaction and the related thrust loss calculation. To warrant highly accurate results the provision of the best available program input data is mandatory, as well as, the use of sophisticated modeling techniques to reduce computation time with advanced error control criteria. The simulation of wall shocks, Mach-shocks, and shocks induced by large concave wall curvature is essential since this interaction with each other produces flow field changes which in turn affect the nozzle performance. Author

N86-28632*# Maryland Univ., College Park. Dept. of Civil Engineering.
COMPARATIVE EFFICIENCY OF FINITE, BOUNDARY AND HYBRID ELEMENT METHODS IN ELASTOSTATICS
C. W. Schwartz and C. W. Lee Jun. 1986 33 p
(NASA-CR-177204; NAS 1.26:177204) Avail: NTIS HC A03/MF A01 CSCL 09B

The comparative computational efficiencies of the finite element (FEM), boundary element (BEM), and hybrid boundary element-finite element (HBFEM) analysis techniques are evaluated for representative bounded domain interior and unbounded domain exterior problems in elastostatics. Computational efficiency is carefully defined in this study as the computer time required to attain a specified level of solution accuracy. The study found the FEM superior to the BEM for the interior problem, while the reverse was true for the exterior problem. The hybrid analysis technique was found to be comparable or superior to both the FEM and BEM for both the interior and exterior problems. Author

N86-28633 Societe Nationale Industrielle Aerospatiale, Paris (France).
IMPACT OF AUTOMATION ON THE DESIGN OF CARBON FIBER OMEGA RIBS
Clariou, Perez, and Plagne 1986 16 p Presented at 3rd Intern. Conf. on Composite Structures, Paisley, Scotland, 9-11 Sep. 1985 (SNIAS-861-422-101; ESA-86-97158) Avail: NTIS HC A02

A method to reduce production costs and improve quality of solar array carbon fiber omega ribs was developed. An automatic laying process was designed, but the definition had to be modified, as the thickness was not constant throughout the section, and the laying was nonsymmetric. Steps decided to change the definition, meet the specifications with the same margins, requalify the new omegas at minimal cost, be sure of reproductibility and quality of the product, and sell it to the customer are outlined. The impact of industrial constraints on the definition and qualification process, and difficulties entailed by such a performance are discussed. ESA

N86-28634*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATOR FOR MULTILEVEL OPTIMIZATION RESEARCH
S. L. Padula and K. C. Young Jun. 1986 35 p
(NASA-TM-87751; NAS 1.15:87751) Avail: NTIS HC A03/MF A01 CSCL 09B

A computer program designed to simulate and improve multilevel optimization techniques is described. By using simple analytic functions to represent complex engineering analyses, the simulator can generate and test a large variety of multilevel decomposition strategies in a relatively short time. This type of research is an essential step toward routine optimization of large aerospace systems. The paper discusses the types of optimization problems handled by the simulator and gives input and output listings and plots for a sample problem. It also describes multilevel implementation techniques which have value beyond the present computer program. Thus, this document serves as a user's manual for the simulator and as a guide for building future multilevel optimization applications. Author

N86-28635*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STAR (SIMPLE TOOL FOR AUTOMATED REASONING): TUTORIAL GUIDE AND REFERENCE MANUAL
Gary C. Borchardt 15 Dec. 1985 198 p
(Contract NAS7-918)
(NASA-CR-177157; JPL-PUB-85-59; NAS 1.26:177157) Avail: NTIS HC A09/MF A01 CSCL 09B

STAR is an interactive, interpreted programming language for the development and operation of Artificial Intelligence application systems. The language is intended for use primarily in the development of software application systems which rely on a combination of symbolic processing, central to the vast majority of AI algorithms, with routines and data structures defined in compiled languages such as C, FORTRAN and PASCAL. References to routines and data structures defined in compiled languages are intermixed with symbolic structures in STAR, resulting in a hybrid operating environment in which symbolic and non-symbolic processing and organization of data may interact to a high degree within the execution of particular application systems. The STAR language was developed in the course of a project involving AI techniques in the interpretation of imaging spectrometer data and is derived in part from a previous language called CLIP. The interpreter for STAR is implemented as a program defined in the language C and has been made available for distribution in source code form through NASA's Computer Software Management and Information Center (COSMIC). Contained within this report are the STAR Tutorial Guide, which introduces the language in a step-by-step manner, and the STAR Reference Manual, which provides a detailed summary of the features of STAR. Author

N86-28636*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
COMPUTER-AIDED MODELING AND ANALYSIS OF POWER PROCESSING SYSTEMS (CAMAPPS), PHASE 1 Final Report
S. Kim, J. Lee, B. H. Cho, and F. C. Lee 1986 211 p
(Grant NAG5-518)
(NASA-CR-177163; NAS 1.26:177163) Avail: NTIS HC A10/MF A01 CSCL 09B

The large-signal behaviors of a regulator depend largely on the type of power circuit topology and control. Thus, for maximum flexibility, it is best to develop models for each functional block a independent modules. A regulator can then be configured by collecting appropriate pre-defined modules for each functional block. In order to complete the component model generation for a comprehensive spacecraft power system, the following modules were developed: solar array switching unit and control; shunt regulators; and battery discharger. The capability of each module is demonstrated using a simplified Direct Energy Transfer (DET) system. Large-signal behaviors of solar array power systems were analyzed. Stability of the solar array system operating points with a nonlinear load is analyzed. The state-plane analysis illustrates trajectories of the system operating point under various conditions. Stability and transient responses of the system operating near the solar array's maximum power point are also analyzed. The solar array system mode of operation is described using the DET spacecraft power system. The DET system is simulated for various operating conditions. Transfer of the software program CAMAPPS (Computer Aided Modeling and Analysis of Power Processing Systems) to NASA/GSFC (Goddard Space Flight Center) was accomplished. B.G.

N86-28637*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
COMPUTER-AIDED MODELING AND ANALYSIS OF POWER PROCESSING SYSTEMS (CAMAPPS). PHASE 1: USERS HANDBOOK
S. Kim, J. Lee, B. H. Cho, and F. C. Lee 15 Mar. 1986 82 p
(Grant NAG5-518)
(NASA-CR-177123; NAS 1.26:177123) Avail: NTIS HC A05/MF A01 CSCL 09B

The EASY5 macro component models developed for the spacecraft power system simulation are described. A brief explanation about how to use the macro components with the EASY5 Standard Components to build a specific system is given through an example. The macro components are ordered according to the following functional group: converter power stage models, compensator models, current-feedback models, constant frequency control models, load models, solar array models, and shunt regulator models. Major equations, a circuit model, and a program listing are provided for each macro component. B.G.

N86-28638# National Bureau of Standards, Gaithersburg, Md.
CSFIT: A FORTRAN PROGRAM FOR CHARGE-SHEET MODEL FITTING OF MOSFET DATA
L. C. Witte Nov. 1985 38 p
(AD-A165708; NBSIR-85-3145) Avail: NTIS HC A03/MF A01 CSCL 09/1

A FORTRAN program, CSFIT, has been developed for fitting an expression for the current-voltage (I-V) characteristics of a long-channel MOSFET to experimental I-V curves. The one-dimensional charge-sheet model developed by Brews provides the basis for the I-V characteristics. The I-V characteristics given by this model are optimized with respect to a set of experimental data using the flatband voltage and the mobility as the only adjustable parameters. The program is written so that multiple sets of I-V data can be fit simultaneously if desired. The user must supply, in specified formats, a current-voltage data file, a device parameter file, and a starting value file. Author (GRA)

N86-28639# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONTACT SURFACE EROSION FOR HYPERVELOCITY PROBLEMS Final Report
Kent D. Kimsey and Jonas A. Zukas Feb. 1986 33 p
(AD-A165723; BRL-MR-3495) Avail: NTIS HC A03/MF A01 CSCL 19/4

This paper presents a technique for extending the capability of Lagrangian wave propagation codes to treatment of deep penetration and spaced plate perforation problems. Lagrangian codes as originally developed required that the sliding interfaces specified at the beginning of a problem remain unchanged throughout the computation. This requirement was imposed not from physical considerations but to simplify the programming of the interface logic. Its effect was to prohibit total failure of material dictated by the physical problem (i.e., front-face spall), resulting in either unrealistic distortions of the computational grid leading to large truncation errors or minuscule temporal integration increments resulting in uneconomical computations. The contact surface erosion algorithm outlined in this paper permits sliding interfaces to be dynamically relocated as materials exceed their load-bearing capability without a prior specification of the damage region. Results obtained with EPIC-2 into which this algorithm has been incorporated show good agreement with experimental data for deep penetration situations as well as for finite plate perforations at striking velocities of 1.1 - 3.75 km/s. GRA

N86-23640# Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
TRANSITION SYSTEMS, INFINITARY LANGUAGES AND THE SEMANTICS OF UNIFORM CONCURRENCY
J. W. deBakker, J.-J. Ch. Meyer, E.-R. Olderog (Kiel Univ., West Germany), and J. I. Zucker (State Univ. of New York, Buffalo) Feb. 1985 11 p Presented at STOC 1985, Providence, R.I., 6-8 May 1985 Revised Sponsored in part by ESPRIT project 415
(IR-96; B8563329; ESA-86-96954) Avail: NTIS HC A02/MF A01

Shuffle and synchronization merge, local and global nondeterminacy, and deadlocks are analyzed by confronting, for three sample languages, semantic techniques proposing an operational approach, a denotational one, and an intermediate role. The operational semantics is based on transition systems. The definitions include the use of a model involving languages with finite and infinite words; the use of full recursion (based on the copy rule) rather than just iteration; a simple treatment of synchronization; distinction between local and global nondeterminacy; and the restriction to uniform concurrency. ESA

N86-28641# Stockholm Univ. (Sweden). Inst. of Physics.
DATA ACQUISITION CONTROLLER REFERENCE MANUALS
Christian Bohm Sep. 1985 39 p
(USIP-85-19; ESA-86-97048) Avail: NTIS HC A03/MF A01

Hardware and software reference manuals describing a data acquisition controller are presented. The unit controls small to medium sized nuclear physics experiments. It connects via a RS-232 link to a host computer (VAX), which stores measuring data and provides ultimate control of the experiment. The controller can autonomously log in and log out from the host. The system, which is equipped with a eurobus backplane, uses a standard CPU, memory, and digital analog interface boards. Two single board multichannel analyzers were designed for multiscaling and for pulse height analysis. ESA

N86-28642# Stockholm Univ. (Sweden). Inst. of Physics.
MONTE CARLO DATA, THEORY AND COMPUTER PROGRAMS INTENDED FOR DATA ANALYSIS AND SIMULATION IN Fe-57 DEPTH-SELECTIVE CONVERSION ELECTRON MOSSBAUER SPECTROSCOPY (DCEMS)
D. Liljequist Oct. 1985 92 p
(USIP-85-20; ESA-86-97049) Avail: NTIS HC A05/MF A01

A program description and user's manual for computer programs and simulated weight function data for Fe-57 depth-selective Mossbauer spectroscopy are given. Calibration of and convolution with the electron spectrometer profile, phase signal theory, the simulation or analysis of phase signals and spectra, a method to correct for the attenuation of incident radiation in the absorber, and the construction and handling of absorber models are covered. ESA

N86-28643# Centre National d'Etudes Spatiales, Toulouse (France).
HIGH BIT RATE STAR MODEL: MEASUREMENT OF THE SAMPLER PERFORMANCE IN THE 2 X 100 Mb/SEC STAR MODEL [MAQUETTE DE LIAISON HAUTE CADENCE STAR: MESURE DES PERFORMANCES DE L'ECHANTILLONEUR 2 X 100 MB/S DE LA MAQUETTE STAR]
J. P. Soldermann 22 Oct. 1984 24 p In FRENCH; ENGLISH summary
(CNES-844/322-T-CT/DRT/TIT/TR; ESA-86-97183) Avail: NTIS HC A02/MF A01

The effect of the different parameters on the bit error rate is measured as a function of the signal to noise ratios. The input filter is designed as a three pole Butterworth filter with a cut-off frequency at twice the bit rate. The phase shift introduced by the 100 MHz reference oscillator error is estimated as 0.67 deg rms and the bit error caused by different time and phase errors are given. It is shown that filter losses are 0.6 dB and regenerator losses are 0.2 dB for 1 per million bit error rate. ESA

N86-28644# Salford Univ. (England). Computer Simulation Center.
CONSOLIDATION AND EXTENSION OF ESL
J. L. Hay, J. G. Pearce, and L. Turnbull Paris ESA Jun. 1985 43 p
(Contract ESA-5663/83-NL-PP)
(CSC-1026/00-FIN3; ESA-CR(P)-2164; ESA-86-96864) Avail: NTIS HC A03/MF A01

The ESA Simulation Language (ESL) was consolidated by programming 10 applications from aerospace engineering. The results demonstrate the ability of ESL to tackle a wide range of problems, many of which contained discontinuous elements. A comprehensive library of common submodels was derived. Minor problems were corrected. Parallel segmentation facilities were added to allow separate partitions, or segments, of a physical system to be simulated on an individual processor of a multiprocessor computer. Thus ESL, which runs on a conventional computer, emulates the multiprocessor system. ESA

N86-28645# Technische Hogeschool, Delft (Netherlands). Lab. voor Informatietheorie.
LECTURE NOTES: CODING [COLLEGEDICTAAT: CODEREN]
D. E. Boekee 28 Jan. 1986 99 p In DUTCH
(ESA-86-96952) Avail: NTIS HC A05/MF A01

Four aspects of variable length codes, i.e., if such a code can be decoded uniquely, the optimal code, the Huffman code, and its practical realization are discussed. Linear channel coding for error detection and correction is considered. Block-type (e.g., polynomial codes and concatenated codes) and convolution codes (e.g., rate-1/2 codes, and rate k/n convolution codes) are distinguished. ESA

N86-28646# Fondazione Ugo Bordoni, Rome (Italy).
IDENTIFICATION OF STABLE NONSTATIONARY LATTICE PREDICTORS BY LINEAR PROGRAMMING
Giuseppe Martinelli, Gianni Orlandi, Lucio PrinaRicotti, and Susanna Ragazzini Sep. 1985 8 p
(FUB-19-1985; ESA-86-97086) Avail: NTIS HC A02/MF A01

A method for constraining the lattice predictor to have coefficients less than a suitable magnitude of the reflection coefficients is presented. The method is based on a linear programming extension of the least mean square criterion, in order to incorporate the constraints. The efficiency of the resulting algorithm is illustrated. ESA

N86-28647# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
OPTIMUM DESIGN USING A PARALLEL ALGORITHM FOR NONLINEAR PROGRAMMING PROBLEMS
Philippe Berger (Ecole Nationale Superieure d'Electronique d'Informatique et d'Hydraulique, Toulouse, France), Michel Dayde, and Jean-Claude Dunyach 1986 8 p In FRENCH Presented at Conf., Berlin, 23-25 Sep. 1985 Submitted for publication
(SNIAS-861-111-105; ESA-86-97142) Avail: NTIS HC A02/MF A01

An algorithm based on a penalty function approach is applied to optimizing the mass of a structure described by finite elements which has given geometric and material properties. The solution is made parallel by adapting a variable metrics algorithm which is intended to solve problems with no constraints. The method was tested on a sequential computer and on a CRAY 1M computer. The simulation indicates a satisfactory performance. It is shown that the method can be used on a large number of nonlinear mathematical programming problems. ESA

N86-28648# Societe Nationale Industrielle Aerospatiale, Paris (France).
DIALOG ABOUT COMPUTER PROGRAMS [DIALOGUE POUR UN LOGICIEL]
Michel Bertaux, Marie-France Murphy, and Pascal Delumeau 1986 5 p In FRENCH
(SNIAS-861-422-106; ESA-86-97163) Avail: NTIS HC A02/MF A01

An imaginary dialog between an engineer and lawyer illustrates the theoretical and practical aspects of the legal protection of computer program intellectual property in France. Recommendations are given in order to assure an effective protection. The extension of the protection to other countries is discussed. ESA

N86-28649# National Bureau of Standards, Gaithersburg, Md. Center for Computer Systems Engineering.
PERFORMANCE MEASUREMENT TECHNIQUES FOR MULTIPROCESSOR COMPUTERS Interim Report
J. W. Roberts Feb. 1986 59 p Sponsored by DARPA
(PB86-186855; NBSIR-85-3296) Avail: NTIS HC A04/MF A01 CSCL 09B

A wide range of possible measures for multiprocessor computers is discussed, along with the realizability of each class of measurement technique and the applicability of the results. GRA

N86-28256*# Software and Engineering Associates, Inc., Carson City, Nev.
TWO-DIMENSIONAL KINETICS COMPUTER PROGRAM FOR ORBIT TRANSFER VEHICLES
G. R. Nickerson and L. D. Dang *In* Johns Hopkins Univ. The

22nd JANNAF Combustion Meeting, Vol. 1 Oct. 1985 p 495-503 (For primary document see N86-28212 19-28)
(Contract NAS8-35931)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

N86-28365# Texas Instruments, Inc., Lewisville.
MISSION BENEFITS OF A VERY HIGH THROUGHPUT IMAGE TRACKER SYSTEM
Joel K. McWilliams and Jack H. Pridgen *In* AGARD The Impact of Very High Performance Integrated Circuits on Radar, Guidance and Avionics Systems Aug. 1985 9 p (For primary document see N86-28337 19-33)
Avail: NTIS HC A17/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N86-28650 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
IMPLEMENTATION ASSESSMENT OF A NETWORK SERVICE. SPECIFICATION OF A CONFORMANCE TEST SUITE
G. W. Cowin and S. E. Hambly Dec. 1985 36 p
(NPL-DITC-67/85; ISSN-0262-5369; ESA-86-97124) Copyright. Avail: Issuing Activity

Systems for testing the conformance of protocol implementations to the protocol specifications were developed. A system to test the implementation of an interim protocol, known as the Yellow Book, which provides a network service over X.25 is presented. The conformance test suite for use with that testing system is described. The relevance of this to work on testing implementations of standard Open Systems Interconnection protocols is in the structure of the test suite and the nature of the purpose of individual tests. ESA

N86-28651*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HARDWARE CONFIGURATION FOR A REAL-TIME MULTIPROCESSOR SIMULATOR
Richard A. Blech and Anthony D. Williams Jul. 1986 21 p
(NASA-TM-88802; E-3141; NAS 1.15:88802) Avail: NTIS HC A02/MF A01 CSCL 09B

The Real-Time Multiprocessor Simulator (RTMPS) is a multiple microcomputer system used to investigate the application of parallel-processing concepts to real-time simulation. This users manual describes the set-up and installation considerations for the RTMPS hardware. Any modifications or further improvements to the RTMPS hardware will be documented in an addendum to this manual. Author

N86-28652# Allied Bendix Aerospace, Kansas City, Mo.
APPLYING PARALLEL DATA PROCESSING TO AUTOMATED TEST EQUIPMENT
E. J. Rolfe and M. D. Boswell Oct. 1985 24 p Presented at the MAECON Conference, Kansas City, Mo., 6 Nov. 1985
(Contract DE-AC04-76DP-00613)
(DE86-002065; BDX-613-3344; CONF-8511116-1) Avail: NTIS HC A02/MF A01

Parallel processing techniques make possible simultaneous acquisitions of product test data through the use of multiple microprocessors. Dedicating one processor with its own memory, analog to digital converter, programmable level detectors, and event timer to each product test point provides flexibility and avoids contentions for measurement resources. Significant increases in speed and reliability over single-processor testers have been achieved. DOE

N86-28653# Argonne National Lab., Ill.
ANL STATEMENT OF SITE STRATEGY FOR AUTOMATED OFFICE SUPPORT SYSTEMS
L. M. Boxberger Nov. 1985 88 p
(Contract W-31-109-eng-38)
(DE86-005673; ANL/TM-432) Avail: NTIS HC A05/MF A01

The Statement of Site Strategy consists primarily of eighteen chapters that together explain the overall Argonne strategy for defining, acquiring, using, and evaluating computing workstations and other automated office support systems. The seven appendices clarify Argonne's responsibilities in managing microprocessors and word processors and in acquiring computing workstation components. DOE

N86-28654# Stockholm Univ. (Sweden). Inst. of Physics.
A MICROPROCESSOR BASED RS-232 EXCHANGE UNIT
C. Bohm, B. Hovander, and H. Haakansson Sep. 1985 14 p
(USIP-85-18; ESA-86-97047) Avail: NTIS HC A02/MF A01

An RS-232 exchange unit, which can accommodate up to 64 ports is described. Any combination of terminals, devices, and computers are allowed, since all ports are physically identical. All standard nonsplit speeds between 110 bauds and 19,200 bauds are supported semiautomatically. The exchange unit is driven by the Data Terminal Ready signal (DTR) in the RS-232 protocol. Assertion of DTR activates the microprocessor controller of the exchange unit, which then assists in establishing the desired connection or providing the specified service. Negating or disconnecting DTR disconnects the channel. ESA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N86-28655# Massachusetts Univ., Amherst. Dept. of Chemical Engineering.
NONLINEAR MODEL CONTROL
S. A. Chesna, M. P. Golden, and B. E. Ydstie 1985 26 p Presented at the American Institute of Chemical Engineers Annual Winter Meeting, Chicago, Ill., 10 Nov. 1985
(Contract DE-FG02-85ER-13318)
(DE86-005699; CONF-851123-9) Avail: NTIS HC A03/MF A01

Significant improvements in control system performance can be obtained if the major process nonlinearities are included in the control system design. Nonlinear model control achieves this through the use of simple parallel and series compensation. The use of this method is explained. New theoretical results on controller robustness are presented; it is in particular shown how series nonlinear model compensation can be used to improve control system performance using steady state design models. The theoretical results are supported by simulation and pilot plant experiments using a self tuning-adaptive regulator and nonlinear model compensation. DOE

N86-28656# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
A POLYNOMIAL APPROACH TO MINIMAX FREQUENCY DOMAIN OPTIMIZATION OF MULTIVARIABLE FEEDBACK SYSTEMS
Huibert Kwakernaak Aug. 1985 35 p
(Memo-529; ISSN-0169-2690; ESA-86-96966) Avail: NTIS HC A03/MF A01

The polynomial matrix approach to the minimax frequency domain optimization of multivariate linear feedback systems is considered. The properties of a feedback system represented by rational transfer matrices for the plant and the compensator are discussed. The fact that good disturbance, robustness, limited bandwidth, and compensator roll-off may be obtained by minimizing a criterion over the norm of a matrix depending on suitable weighting matrices, is reported. Numerical solutions of the polynomial equations are discussed. The choice of weighting matrices to ensure required feedback system properties is considered. ESA

N86-28657# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and

System Theory.

A NOTE ON THE STRUCTURE OF TWO SUBSETS OF THE PARAMETERS SPACE IN ADAPTIVE CONTROL PROBLEMS

J. W. Polderman Sep. 1985 13 p Submitted for publication
(CWI-OS-R8509; B8577111; ESA-86-96991) Avail: NTIS HC A02/MF A01

Two subsets (state space and cost criterion) of the parameter space in adaptive control problems for the discrete and continuous cases are studied. The geometric, algebraic and topological properties of these subsets are reported. The fact that the results for these two cases (discrete and continuous) are identical geometrically, but algebraically and topologically different, is reported. ESA

N86-28658# Sheffield Univ. (England). Dept. of Control Engineering.

STABILIZABILITY OF FINITE AND INFINITE DIMENSIONAL BILINEAR SYSTEMS

S. P. Banks 1985 27 p
(RR-283; ESA-86-97136) Avail: NTIS HC A03/MF A01

The stabilizability of a general bilinear system in finite and infinite-dimensional spaces is considered. The stabilizing feedback controller is defined in such a way that the resulting system is of the variable-structure type with a stable sliding mode on a subspace of a state space. This leads to unbounded controls in the neighborhood of the set, but in many cases a simple perturbation of the switching manifolds leads to a bounded controller. In the finite-dimensional case, nonlinear control is discussed. The existence of switching manifolds defined by the solutions of polynomial equations is shown. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-28659 National Physical Lab., Teddington (England). Div. of Informatics Technology and Computing.

SHAPE-PRESERVING SPLINE APPROXIMATION IN THE l1-NORM

Maurice G. Cox and Helen M. Jones Dec. 1985 18 p
(NPL-DITC-68/85; ISSN-0262-5369; ESA-86-97125) Copyright. Avail: Issuing Activity

Approximating a set of discrete data by a function of one independent variable is considered. This function is required to satisfy certain properties relating to its shape. The approximating function used is a polynomial spline expressed as a linear combination of B-spline basis functions. The algorithm for solving this problem minimizes the departure of the approximating spline from the data in the l1-norm. ESA

N86-28660*# Virginia Univ., Charlottesville. Dept. of Mathematics.

MULTI-COLOR INCOMPLETE CHOLESKY CONJUGATE GRADIENT METHODS FOR VECTOR COMPUTERS Ph.D. Thesis

Eugene L. Poole May 1986 125 p
(Grant NAG1-242)
(NASA-CR-178117; NAS 1.26:178117) Avail: NTIS HC A06/MF A01 CSCL 12A

In this research, we are concerned with the solution on vector computers of linear systems of equations, $Ax = b$, where A is a larger, sparse symmetric positive definite matrix. We solve the system using an iterative method, the incomplete Cholesky conjugate gradient method (ICCG). We apply a multi-color strategy to obtain p-color matrices for which a block-oriented ICCG method is implemented on the CYBER 205. (A p-colored matrix is a matrix which can be partitioned into a pXp block matrix where the diagonal blocks are diagonal matrices). This algorithm, which is based on a no-fill strategy, achieves O(N/p) length vector operations in both the decomposition of A and in the forward and back solves necessary at each iteration of the method. We discuss the natural ordering of the unknowns as an ordering that minimizes the number of diagonals in the matrix and define multi-color orderings in terms of disjoint sets of the unknowns. We give necessary and sufficient conditions to determine which multi-color orderings of the unknowns correpond to p-color matrices. A performance model is given which is used both to predict execution time for ICCG methods and also to compare an ICCG method to conjugate gradient without preconditioning or another ICCG method. Results are given from runs on the CYBER 205 at NASA's Langley Research Center for four model problems. Author

N86-28661*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLUTION OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS BY FAST POISSON SOLVERS USING A LOCAL RELAXATION FACTOR. 1: ONE-STEP METHOD

Sin-Chung Chang May 1986 22 p Presented at the Ninth International Conference on Numerical Methods in Fluid Dynamics, Saclay, France, 25-29 Jun. 1984
(NASA-TP-2529; E-2461-1; NAS 1.60:2529) Avail: NTIS HC A02/MF A01 CSCL 12A

An algorithm for solving a large class of two- and three-dimensional nonseparable elliptic partial differential equations (PDE's) is developed and tested. It uses a modified D'Yakanov-Gunn iterative procedure in which the relaxation factor is grid-point dependent. It is easy to implement and applicable to a variety of boundary conditions. It is also computationally efficient, as indicated by the results of numerical comparisons with other established methods. Furthermore, the current algorithm has the advantage of possessing two important properties which the traditional iterative methods lack; that is: (1) the convergence rate is relatively insensitive to grid-cell size and aspect ratio, and (2) the convergence rate can be easily estimated by using the coefficient of the PDE being solved. Author

N86-28662*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PHYSICAL AND NUMERICAL SOURCES OF COMPUTATIONAL INEFFICIENCY IN INTEGRATION OF CHEMICAL KINETIC RATE EQUATIONS: ETIOLOGY, TREATMENT AND PROGNOSIS

David T. Pratt (Washington Univ., Seattle) and Krishnan Radhakrishnan May 1986 12 p
(Grant NAG3-147)
(NASA-TP-2590; E-2587; NAS 1.60:2590) Avail: NTIS HC A02/MF A01 CSCL 12A

The design of a very fast, automatic black-box code for homogeneous, gas-phase chemical kinetics problems requires an understanding of the physical and numerical sources of computational inefficiency. Some major sources reviewed in this report are stiffness of the governing ordinary differential equations (ODE's) and its detection, choice of appropriate method (i.e., integration algorithm plus step-size control strategy), nonphysical initial conditions, and too frequent evaluation of thermochemical and kinetic properties. Specific techniques are recommended (and some advised against) for improving or overcoming the identified problem areas. It is argued that, because reactive species increase exponentially with time during induction, and all species exhibit asymptotic, exponential decay with time during equilibration, exponential-fitted integration algorithms are inherently more accurate for kinetics modeling than classical, polynomial-interpolant methods for the same computational work. But current codes using the exponential-fitted method lack the sophisticated stepsize-control logic of existing black-box ODE solver codes, such as EPISODE and LSODE. The ultimate chemical kinetics code does not exist yet, but the general characteristics of such a code are becoming apparent. Author

N86-28663# Systems Control Technology, Inc., Palo Alto, Calif.

PARAMETRIC TECHNIQUES FOR MULTICHANNEL SIGNAL PROCESSING Final Report, 1 Sep. 1983 - 30 Oct. 1985

Benjamin Friedlander Oct. 1985 398 p

(Contract DAAG29-83-C-0027)
(AD-A165649; Rept-5498-07; ARO-19707.19-EL) Avail: NTIS HC A17/MF A01 CSCL 12/1

This final report summarizes results on the development of parametric techniques for multichannel signal processing. Results include the development of accurate ARMA spectrum estimation techniques with modest computational complexity, and the development of asymptotic performance bounds for the evaluation of the accuracy of these techniques. GRA

N86-28664# Royal Signals and Radar Establishment, Malvern (England).
ON EXTENSIONS TO FISHER'S LINEAR DISCRIMINANT FUNCTION
I. D. Longstaff Nov. 1985 16 p
(AD-A165661; RSRE-MEMO-3897; DRIC-BR-98722) Avail: NTIS HC A02/MF A01 CSCL 12/1

This Memorandum describes how Fisher's Linear Discriminant can be combined with the Fukunaga-Koontz transform to give a useful technique for reduction of feature space from many to two or three dimensions. Performance is seen to be superior in general to the Foley-Sammon extension to fisher's method. The technique is then extended to show how a new radius vector (or pair of radius vectors) can be combined with fisher's vector to produce a classifier with even more power of discrimination. Illustrations of the technique show that good discrimination can be obtained even if there is considerable overlap of classes in any single projection. GRA

N86-28665# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
PROGRESS ON H (AT INFINITY) OPTIMAL SENSITIVITY FOR DELAY SYSTEMS. PART 1: MINIMUM PHASE PLANT WITH INPUT DELAY. 1 POLE/ZERO WEIGHTING FUNCTION
David S. Flamm and Sanjoy K. Mitter 22 Nov. 1985 34 p
(Contracts DAAG29-84-K-0005; Grant AF-AFOSR-82-0135B)
(AD-A165766; LIDS-P-1513-Pt-1; ARO-20980.43-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this report we derive the solution of the minimal weighted sensitivity problem with 1 pole/1 zero sensitivity weighting functions for stable minimum phase rational plants with an input delay. We calculate the explicit feedback compensator and analyze its stability. Although we have a technique for approximating these compensators with proper compensators, the full description of this, along with an analysis of stability robustness will appear in a future report. Another report will also cover generalizations of this work to plants which are unstable, to plants which have right half plane zeros, and to the case of a more general sensitivity weighting function. GRA

N86-28666# Sandia National Labs., Albuquerque, N. Mex.
OVERVIEW OF PRECONDITIONED CONJUGATE GRADIENT (PCG) METHODS IN CONCURRENT FINITE ELEMENT ANALYSIS
R. E. Benner and G. R. Montry 13 Jan. 1986 15 p
(Contract DE-AC04-76DP-00789)
(DE86-006659; SAND-85-2727) Avail: NTIS HC A02/MF A01

The theory of preconditioned conjugate gradient (PCG) methods is discussed, with emphasis on the features of this class of iterative methods that make them amenable to, or pose problems for, finite element analysis in a parallel processing environment. The discussion focuses on symmetric, positive definite (SPD) matrix equations (which, for example, are commonplace in solid mechanics), with mention of the state-of-the-art of PCG methods generalized for non-SPD problems (which often arise in fluid mechanics). A new class of preconditioners is proposed (and is now being tested), based on experience with both direct and iterative methods for concurrent solution of finite element equations. Results of research with both conventional and novel PCG algorithms will appear in subsequent reports. DOE

N86-28667# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
ERROR ESTIMATES AND AUTOMATIC TIME STEP CONTROL FOR NONLINEAR PARABOLIC PROBLEMS, PART 1
Kenneth Eriksson and Claes Johnson 1985 24 p
(CTH-Math-1985-20-Pt-1; ISSN-0347-2809; ESA-86-97021) Avail: NTIS HC A02/MF A01

Results on time discretization error estimates and related automatic time step control for stiff ordinary differential equations are extended to the case of a nonlinear parabolic problem. The method for time discretization is the discontinuous Galerkin method based on using piecewise polynomials of degree $q > \text{or} = 0$. The case $q = 0$, corresponding to a variant of the backward Euler method is treated. An almost optimal error estimate is proved, and a related algorithm for automatic time step control which is very simple but is efficient and gives control of the global error is presented. ESA

N86-28668# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
AN A POSTERIORI ERROR ESTIMATE AND AUTOMATIC TIME STEP CONTROL FOR A BACKWARD EULER DISCRETIZATION OF A PARABOLIC EQUATION
Claes Johnson, Yi-Yong Nie, and Vidar Thomee 1985 27 p
(CTH-Math-1985-23; ISSN-0347-2809; ESA-86-97024) Avail: NTIS HC A03/MF A01

A simple algorithm for automatic time step control for a backward Euler discretization of a linear parabolic problem is presented. The algorithm is based on an a posteriori error estimate involving the computed approximate solution. It is proved that, with only very rough a priori information of the exact solution, the algorithm chooses the correct sequence of time steps, except possibly for a few initial steps, to guarantee global error control to a certain given tolerance. ESA

N86-28669# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
CONVERGENCE ANALYSIS FOR A NONSYMMETRIC GALERKIN METHOD FOR A CLASS OF SINGULAR BOUNDARY VALUE PROBLEMS IN ONE SPACE DIMENSION
Kenneth Eriksson and Yi-Yong Nie 1985 31 p
(CTH-Math-1985-24; ISSN-0347-2809; ESA-86-97025) Avail: NTIS HC A03/MF A01

A nonsymmetric Galerkin type piecewise polynomial approximation procedure for a class of singular boundary value problems in one space dimension is extended to the case of mildly nonlinear problems with the same type of singularity. The discretization of the stationary problem is analyzed with respect to super convergence properties at the nodal points. To obtain full superconvergence at all nodal points local mesh refinements must be introduced, even though the exact solution is smooth for the given class of problems. ESA

N86-28670# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
CONVERGENCE OF A FINITE ELEMENT METHOD FOR A NONLINEAR HYPERBOLIC CONSERVATION LAW
Claes Johnson and Anders Szepessy 1985 15 p
(CTH-Math-1985-25; ISSN-0347-2809; ESA-86-97026) Avail: NTIS HC A02/MF A01

A finite element method for a time dependent nonlinear hyperbolic conservation law in one space dimension (Burger's equation) is considered. The finite element method is higher order accurate and is a Petrov-Galerkin method based on the so-called streamline diffusion modification of the test functions giving added stability. Assuming uniform boundedness of the finite element solutions, it is proved, using a compensated compactness result by Murat-Tartar, convergence to the entropy solution of the conservation law as the mesh parameter tends to zero. ESA

N86-28671# Leiden Univ. (Netherlands).
A DENSITY DEPENDENT DIFFUSION EQUATION IN POPULATION DYNAMICS: STABILIZATION TO EQUILIBRIUM
M. Bertsch and D. Hilhorst 1986 43 p
(ESA-86-96956) Avail: NTIS HC A03/MF A01

A problem (P) of the theory of population dynamics over a finite habitat composed by two different age groups when the boundary conditions are supposed that no individuals can leave or enter the habitat, is considered. This problem is studied as a nonlinear evolution problem. The large time behavior of the solutions of P is discussed and the results of existence, uniqueness, and regularity of solutions of P are reported. The construction of a Lyapunov functional for the contraction property for solutions of P and for the relations between P and the Dirichlet problem is discussed. ESA

N86-28672# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
SYMMETRY TRANSFORMATIONS IN INDEFINITE METRIC SPACES
P. M. vandenBroek Aug. 1984 19 p
(Memo-428; ESA-86-96963) Avail: NTIS HC A02/MF A01

Three properties between whose relations there exists symmetry transformations and semilinear operators over a n-dimensional complex vector space with a indefinite metric, are proved. Wigner's theorems for indefinite metric spaces are generalized. ESA

N86-28673# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
THE USE OF MATHEMATICAL OPTIMIZATION TECHNIQUES BY THE DESIGNER
R. F. vandenDam 25 Jan. 1985 46 p In DUTCH; ENGLISH summary Presented at Congress on Computer Applications in Production and Engineering (CAPE) Nederland '85, Amsterdam, Netherlands, May 1985
(NLR-MP-85005-U; B8578430; ESA-86-96975) Avail: NTIS HC A03/MF A01

Mathematical optimization techniques in the design process and their use by designers are discussed. The principles underlying these techniques and the requirements for a flexible optimization system having a broad applicability are considered. Optimization techniques used in aeronautical engineering are reviewed and illustrated with the examples of the System for the Analysis and Constrainted Minimization of Induced Drag and Computational Aerodynamic Design-by-Optimization System. ESA

N86-28674# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Applied Mathematics.
UNIFORM ASYMPTOTIC EXPANSION FOR A CLASS OF POLYNOMIALS BIORTHOGONAL ON THE UNIT CIRCLE
N. M. Temme Sep. 1985 9 p Submitted for publication
(CWI-AM-R8512; B8578046; ESA-86-96998) Avail: NTIS HC A02/MF A01

A family of orthogonal polynomials on the disk unit with respect to the classical weight function is considered. The fact that the zeros of the weight functions can explain the asymptotic behavior of orthogonal or biorthogonal polynomials is studied. A uniform asymptotic expansion for this family of polynomials biorthogonal on the unit circle is given. The result is valid for the parameter over compact subsets of complex numbers without zero. This result is not valid for all hypergeometric functions. ESA

N86-28675# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Applied Mathematics.
ON THE COMPUTATION OF THE INCOMPLETE GAMMA FUNCTIONS FOR LARGE VALUES OF THE PARAMETERS
N. M. Temme Sep. 1985 10 p Submitted for publication
(CWI-AM-R8513; B8578047; ESA-86-96999) Avail: NTIS HC A02/MF A01

The incomplete gamma function, as a function of two variables that are supposed to be non-negative, is considered. A method for the asymptotic representation for the incomplete gamma function is given. A series expansion of the coefficients generated by simple recursion is used. An algorithm for the computation of the incomplete gamma function for large values of the parameters is constructed. Legendre's continued fractions method and the Taylor series are used. The algorithm gives a remarkable reduction in computational effort compared with other methods. ESA

N86-28676# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Applied Mathematics.
INCOMPLETE LAPLACE INTEGRALS: UNIFORM ASYMPTOTIC EXPANSIONS WITH APPLICATION TO THE INCOMPLETE BETA FUNCTION
N. M. Temme Oct. 1985 29 p Submitted for publication
(CWI-AM-R8514; B8578048; ESA-86-97000) Avail: NTIS HC A03/MF A01

The properties of the asymptotic expansion of one incomplete Laplace integral (quotient of the Laplace transformation and the gamma function) are studied. The representation of the remainders, the asymptotic nature of the expansion, and the construction of error bounds are given. This method answers an open problem for incomplete Beta function. Application over expansions for the incomplete Beta function are reported. ESA

N86-28677# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Applied Mathematics.
HOPF BIFURCATION IN HOST-PARASITOID MODELS
H. A. Lauwerier Nov. 1985 21 p
(CWI-AM-R8516; B8578050; ESA-86-97002) Avail: NTIS HC A02/MF A01

A host-parasitoid model of generation n with explicit Arnold normal form is studied. The fact that the Hopf bifurcation, the shape, and size of the elliptic limit curve can be derived in terms of the parameter of the model is proved. The fact that models have a rich bifurcation behavior with both forward and backward Hopf bifurcations and with a transition zone in the parameter for which there exists a pair of limit curves, one stable and one unstable, is revealed by numerical experiments. ESA

N86-28678# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
INFINITE STREAMS AND FINITE OBSERVATIONS IN THE SEMANTICS OF UNIFORM CONCURRENCY
J. W. deBakker, J.-J. Ch. Meyer, and E.-R. Olderog Sep. 1985 26 p Submitted for publication Sponsored by European Economic Commission ESPRIT Project 415
(CWI-CS-R8512; B8575493; ESA-86-97003) Avail: NTIS HC A03/MF A01

Two ways of assigning meaning to a language with uniform concurrency are compared. The language has uninterpreted elementary actions from which statements are composed using sequential composition, nondeterministic choice, parallel composition with communication, and recursion. The first semantics uses infinite streams in the sense which is a refinement of the linear time semantics of De Bakker et al. The second semantics uses the finite observations of Hoare et al., situated in between the divergence and readiness semantics of Olderog & Hoare. It is shown that the two models are isomorphic and that this isomorphism induces an equivalence result between the two semantics. The hiding operation inspired by the infinite streams approach is defined. The continuity of this operation is proved in the framework of finite observations. ESA

N86-28679# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
RIEMANN-ROCH THEOREM FOR LOCALLY PRINCIPAL ORDERS
Juliusz Brzezinski 1985 15 p
(CTH-Math-1985-27; ISSN-0347-2809; ESA-86-97028) Avail: NTIS HC A02/MF A01

A smooth integral projective curve C over the field k, and algebraically closed field in the function field K of C, is considered. The fact that Witt's version of Riemann-Roch theorem can be extended to a class of C-order lambda in arbitrary finitely dimensional semisimple separable algebras is reported. The fact that the maximal orders are locally principal but not always hereditary is shown. Properties for orders in quaternion algebras are given. ESA

N86-28680# Fondazione Ugo Bordoni, Rome (Italy).
THE REPRESENTATION OF CERTAIN INTEGERS AS A SUM OF DISTINCT FIBONACCI NUMBERS
Piero Filipponi Mar. 1985 24 p
(FUB-3-1985; ESA-86-97082) Avail: NTIS HC A02/MF A01

Classes of integers for which the number of F-addends (distinct nonconsecutive Fibonacci numbers) can be expressed in a closed form are studied. The F-addend representation of several classes of the set (Kn) of Fibonacci and Lucas related integers is established. On the basis of the uniqueness of this representation, the value of f(Kn) is found by simply enumerating the addends. The algebraic sum of Fibonacci and lucas numbers; product of Fibonacci and Lucas numbers; ratio of particular Fibonacci and Lucas numbers; and generalized Fibonacci numbers having particular initial values are considered. ESA

N86-28681# Sheffield Univ. (England). Dept. of Control Engineering.
ON THE GLOBAL BILINEARIZATION OF NONLINEAR SYSTEMS AND THE EXISTENCE OF VOLTERRA SERIES
S. P. Banks 1985 17 p
(RR-286; ESA-86-97138) Avail: NTIS HC A02/MF A01

A global Volterra series for an analytic system defined on an analytic manifold M is developed. Local bilinearizations are pieced together using the theory of fiber bundles, giving twisted bilinear systems defined globally on M. ESA

N86-28682# Vrije Universiteit, Amsterdam (Netherlands). Dept. of Mathematics.
GAUSSIAN ELIMINATION ALGORITHMS ON A VECTOR COMPUTER
W. Hoffmann Jun. 1985 19 p
(Rept-85-10; ESA-86-96332) Avail: NTIS HC A02/MF A01

Algorithms for the triangular factorization of square matrices are classified. These factorizations are used for the solution of a linear system. Criteria for optimal algorithms on vector computers are given and comparative experiments in FORTRAN 77 with FORTRAN 200 extensions for the Cyber 205 are reported. The FORTRAN 200 application is quicker. ESA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-28683*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STEADY-STATE PROBABILITY DENSITY FUNCTION OF THE PHASE ERROR FOR A DPLL WITH AN INTEGRATE-AND-DUMP DEVICE
M. Simon and A. Mileant 15 Apr. 1986 26 p
(Contract NAS7-918)
(NASA-CR-177160; JPL-PUB-86-3; NAS 1.26:177160) Avail: NTIS HC A03/MF A01 CSCL 12A

The steady-state behavior of a particular type of digital phase-locked loop (DPLL) with an integrate-and-dump circuit following the phase detector is characterized in terms of the probability density function (pdf) of the phase error in the loop. Although the loop is entirely digital from an implementation standpoint, it operates at two extremely different sampling rates. In particular, the combination of a phase detector and an integrate-and-dump circuit operates at a very high rate whereas the loop update rate is very slow by comparison. Because of this dichotomy, the loop can be analyzed by hybrid analog/digital (s/z domain) techniques. The loop is modeled in such a general fashion that previous analyses of the Real-Time Combiner (RTC), Subcarrier Demodulator Assembly (SDA), and Symbol Synchronization Assembly (SSA) fall out as special cases. Author

N86-28684# Los Alamos National Lab., N. Mex.
FRONTIERS OF QUANTUM MONTE CARLO WORKSHOP: PREFACE
J. E. Gubernatis 1985 13 p Presented at the Frontiers of Quantum Monte Carlo Conference, Los Alamos, N. Mex., 3 Sep. 1985
(Contract W-7405-eng-36)
(DE86-006021; LA-UR-86-209; CONF-8509213-5) Avail: NTIS HC A02/MF A01

The introductory remarks, table of contents, and list of attendees are presented from the proceedings of the conference. The conference covered a wide range of topics using the Monte Carlo method and computerized simulation. The sessions were divided into areas covering computers and science, condensed matter physics, chemistry, atomic molecular and nuclear physics, high energy physics, and advanced computer designs. E.R.

N86-28685# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
GAMES WITH DISASTER (D) AND T EVENTS
Lennart Raade 1985 27 p
(CTH-Math-1985-21; ISSN-0347-2809; ESA-86-97022) Avail: NTIS HC A03/MF A01

The duration of various games is studied. At each round of the game a disaster event can occur, which implies that the game is started afresh. There is also the possibility for a T-event which leads to the termination of the game. This is extended to continuous time. Applications including one from reliability theory are discussed. Additional event method (collective marks method) is used. ESA

N86-28686# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
R-CENSORING AND THE EXPONENTIAL DISTRIBUTION
Lennart Raade 1985 39 p
(CTH-Math-1985-22; ISSN-0347-2809; ESA-86-97023) Avail: NTIS HC A03/MF A01

A censoring method, R-censoring, in life testing experiments is studied for the case of exponentially distributed life times. The R-censoring method means that instead of observing the life time xi, min(xi, eta) where eta is a random variable independent of xi is observed. The case where only some of the tested units are R-censored (partial R-censoring) is treated. A combination of R-censoring and type 2 censoring is investigated. ESA

N86-28687# Sheffield Univ. (England). Dept. of Control Engineering.
CORRELATION BASED MODEL VALIDITY TESTS FOR NONLINEAR MODELS
S. A. Billings and W. S. F. Voon Oct. 1985 19 p Sponsored by UK Science and Engineering Research Council
(RR-285; ESA-86-97137) Avail: NTIS HC A02/MF A01

Model validity tests for nonlinear systems were developed. It is shown that covariance tests developed for linear systems provide incorrect information when applied to nonlinear systems and tests based on higher order correlation functions were derived. The application and interpretation of these tests to simulated and real data is demonstrated. The tests detect omitted linear and nonlinear dynamic terms in estimated models. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N86-28688*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN OF ADAPTIVE CONTROL SYSTEMS BY MEANS OF SELF-ADJUSTING TRANSVERSAL FILTERS
S. J. Merhav Feb. 1986 69 p
(NASA-TM-86843; A-85418; NAS 1.15:86843) Avail: NTIS HC A04/MF A01 CSCL 12B

The design of closed-loop adaptive control systems based on nonparametric identification was addressed. Implementation is by self-adjusting Least Mean Square (LMS) transversal filters. The

design concept is Model Reference Adaptive Control (MRAC). Major issues are to preserve the linearity of the error equations of each LMS filter, and to prevent estimation bias that is due to process or measurement noise, thus providing necessary conditions for the convergence and stability of the control system. The controlled element is assumed to be asymptotically stable and minimum phase. Because of the nonparametric Finite Impulse Response (FIR) estimates provided by the LMS filters, a-priori information on the plant model is needed only in broad terms. Following a survey of control system configurations and filter design considerations, system implementation is shown here in Single Input Single Output (SISO) format which is readily extendable to multivariable forms. In extensive computer simulation studies the controlled element is represented by a second-order system with widely varying damping, natural frequency, and relative degree.
Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-28689# Joint Inst. for Nuclear Research, Dubna (USSR).
SOME PROPERTIES OF CONTRAINTS IN THEORIES WITH DEGENERATE LAGRANGIANS
A. M. Chervyakov and V. V. Nesterneko 1984 14 p Presented at the 7th International Seminar on High Energy Physics Problems, Mutliquark Interactions and Quantum Chromodynamics, Dubna, USSR, 19 Jun. 1984 Submitted for publication
(DE86-700235; JINR-E-2-84-470; CONF-8406221-5) Avail: NTIS (US Sales Only) HC A02/MF A01

By means of the second Noether theorem it is shown that the action invariance under the transformations with arbitrary functions of time results in primary constraints, which are in involution between themselves at least in a weak sense. The Lagrangian constraints were proved to be invariant relations for the Euler equations. In the framework of the Lagrangian formalism a criterion of the appearance in the degenerate theory of the second class constraints is proposed. The Poisson brackets of the primary constraints with the canonical Hamiltonian are determined.
Author

N86-28690# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Mathematics.
ON THE ENSKOG EQUATION IN TWO SPACE VARIABLES
Leif Arkeryd 1985 16 p
(CTH-Math-1985-26; ISSN-0347-2809; ESA-86-97027) Avail: NTIS HC A02/MF A01

The existence problem for the weak Enskog equation in two space-variables far from equilibrium is studied. As a corollary, an existence result for the Boltzmann equation for inverse jth power forces and angular cutt-ff when $2 < j < \text{or} = 3$ is obtained.
ESA

N86-28691# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
AN EXTENDED FORMULATION OF MAXWELL'S EQUATIONS
B. Lehnert Oct. 1985 16 p
(TRITA-EPP-85-05; ISSN-0348-7539; ESA-86-97031) Avail: NTIS HC A02/MF A01

An extended Lorentz invariant formulation of Maxwell's equations which includes time dependent and steady state solutions is presented. The charge and current densities are treated as intrinsic properties of the electromagnetic field itself, in vacuo. A longitudinal electric wave is predicted to propagate in vacuo. An axially symmetric steady state in which self-confined electromagnetic radiation circulates in closed orbits around the axis of symmetry can be outlined. For this state values of the charge, the spin, and the product between magnetic moment and mass which are of the same order of magnitude as those observed for elementary particles such as the proton and electron are obtained.
ESA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-28692*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GATING CHARACTERISTICS OF PHOTOMULTIPLIER TUBES FOR LIDAR APPLICATIONS
John D. W. Barrick Aug. 1986 25 p
(NASA-TM-87699; L-16112; NAS 1.15:87699) Avail: NTIS HC A02/MF A01 CSCL 20C

A detector test facility was developed and applied in the evaluation and characterization of lidar detectors in support of the multipurpose airborne differential absorption lidar (DIAL) system based at the Langley Research Center (LaRC). A performance data base of various detector configurations available to the DIAL system was obtained for optimum lidar detector selection. Photomultiplier tubes (PMT's) with multialkaline and bialkaline photocathodes were evaluated in voltage-divider networks (bases) by using either the focusing electrode or dynodes as a gating mechanism. Characteristics used for detector evaluation included gain stability, signal rise time, and the ability to block unwanted high light levels.
Author

N86-28693# Brookhaven National Lab., Upton, N. Y.
COOLING HIGH INTENSITY ATOMIC HYDROGEN BEAMS TO LIQUID HELIUM TEMPERATURES
A. Hershcovitch, A. Kponou, and T. O. Niinihoski 1986 13 p Presented at the International Workshop on Polarized Sources and Targets, Montana, Switzerland, 13 Jan. 1986
(Contract DE-AC02-76CH-00016)
(DE86-005814; BNL-37537; CONF-860126-1) Avail: NTIS HC A02/MF A01

An atomic hydrogen source, designed to operate in the laminar flow range, has been built at BNL. A unique feature of this source is a miniature gap between a teflon tube which guides the beam and an accommodator which cools it. Across this gap a step-function in temperature, with the teflon temperature exceeding 100°K and the accommodator temperature as low as 3°K, was successfully maintained. This configuration collimates the beam enough to prevent significant diffusive losses without subjecting it to the temperature range of high recombination. Record H^0 beam flux of 3.32×10^{15} H^0/sr-sec was obtained at an accommodation temperature of 5.5°K.
DOE

N86-28694# Joint Publications Research Service, Arlington, Va.
USSR REPORT: CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY
25 Apr. 1986 62 p Transl. into ENGLISH from various Russian articles
(JPRS-UCC-86-004) Avail: NTIS HC A04/MF A01

Topics on cybernetics, computers, and automation technology include: hardware, software, applications, and education. For individual titles, see N86-28695 through N86-28697.

N86-28695# Joint Publications Research Service, Arlington, Va.
A NEW WAY OF HOLOGRAPHIC RECORDING OF INFORMATION c35
A. A. Vasilyev, P. V. Vashurin, V. A. Yelkhov, I. N. Kompanyets, A. V. Prafenov, and P. M. Semochkin *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-004) 25 Apr. 1986 p 10 Transl. into ENGLISH from Priroda (Moscow, USSR), no. 12, Dec. 1985 p 104 (For primary document see N86-28694 19-70)
Avail: NTIS HC A04/MF A01

A system of holographic paged recording of information was developed. The system is characterized by a higher recording density and protection from interference. Basically, these advantages become apparent with the recording of large files of information (pages of text, sketches, and pictures). The output of such files is highly effective with the help of space-time light modulators, from which liquid-crystal models obtained the greatest

diffusion. The method of recording of holograms is characterized both by a heightened contrast of a picture, and by considerable reduction of requirements of uniformity of the thickness of the liquid-crystal layer. This is connected to the fact that in it is used phased bunch modulation, which (in contrast to amplitude) is much less sensitive to the nonuniform thickness 1 to 2 microns it manages to obtain a contrast of 30:1. B.G.

N86-28696# Joint Publications Research Service, Arlington, Va.
DISCOVERY IN LOW-TEMPERATURE PHYSICS
Ivan Ivanov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-004) 25 Apr. 1986 p 12 Transl. into ENGLISH from Tass (Moscow, USSR), 14 Jan. 1986 (For primary document see N86-28694 19-70)
Avail: NTIS HC A04/MF A01

The properties of the helium-3 isotope, liquefied and cooled to 0.0004 degree Kelvin were studied. The liquid helium isotope is placed in a honeycomb-like cell and excited with an electromagnetic pulse. Part of the liquid acquires magnetic properties while the rest of the liquid loses them, which indicates the transfer of magnetism. Given such unusual properties under temperatures close to absolute zero, the helium-3 isotope can be used in computers to improve capacity and increase speed. B.G.

N86-28697# Joint Publications Research Service, Arlington, Va.
INFORMATION SYSTEMS FOR LIBRARY DATABASES ORGANIZED **c82**
Toomas Etverk *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-004) 25 Apr. 1986 p 27-30 Transl. into ENGLISH from Rahva Haal (Tallinn, Estonia), 31 Jul. 1985 p 2 (For primary document see N86-28694 19-70)
Avail: NTIS HC A04/MF A01

One of the important resources for speeding up progress in science and technology is the Automated Remote Inquiry System of Scientific Information (TAKS), which is described. In the Soviet Union, an Automated System of the State Science and Technology Information (VINTI) is being established which comprises a system of large information centers. The effective use of the bibliographical retrospective data bases is discussed. B.G.

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-28698 National Physical Lab., Teddington (England). Div. of Materials Applications.
AN FFT MICROCOMPUTER PROGRAM FOR DETERMINING THE VELOCITY OF ULTRASONIC WAVES
A. Woolf Nov. 1985 16 p
(NPL-DMA(A)106; ISSN-0143-7313; ESA-86-97127) Copyright. Avail: Issuing Activity

A fast Fourier transform subroutine was written for the BBC microcomputer and applied to the determination of the velocity of ultrasonic Lamb wave pulses. Results show that the BBC micro is powerful enough to transform a pulse of 1024 points in 2.4 min; for 512 points the transform time is 1.1 min. There are problems associated with recording only part of the Lamb wave pulse. If only part of the pulse is recorded then an uncertain error is introduced into the velocity determinations. For the application of fast Fourier transform techniques to Lamb wave velocity measurements to be successful, it is necessary to work with shorter pulses than those studied. ESA

N86-28699# Admiralty Research Establishment, Portland (England).
THE OPTIMIZATION OF GAIN FOR CHEBYSCHEV SHADED LINEAR ARRAYS
G. J. Kirby Aug. 1985 51 p
(ARE(PORTLAND)TN-743/85; BR97269; ESA-86-97109) Avail: NTIS HC A04/MF A01

The theory of oversteered shaded arrays is used to predict that Chebyschev arrays should have array gains significantly greater than unshaded arrays in isotropic noise. For arrays with up to 10 hydrophones, Chebyschev arrays can achieve an array gain close to N squared where N is the number of hydrophones. ESA

N86-28700# Imperial Coll. of Science and Technology, London (England). Tribology Section.
RESEARCH INTO AN ON-LINE DEVICE FOR MONITORING CONTAMINATION IN FLUIDS USING ULTRASONIC TECHNIQUES Final Report
C. J. Harries, R. S. Sayles, and P. B. Macpherson Dec. 1984 107 p
(Contract MOD(RAE)-A12/1584)
(TS011/84; BR96168; ESA-86-97120) Avail: Issuing Activity

A prototype ultrasonic device for on-line monitoring of particles within lubricant and hydraulic systems was developed. The technique is shown to operate successfully with small hard particles in the range 30 to 1000 microns suspended in a lubricant and in a range of concentrations typical of lubricant and hydraulic systems. The device is shown to offer continuous information on particle size, concentration, and possibly material. Research needed to realize the full potential of the device, and in particular, overcoming the problems posed by entrained air, is detailed. ESA

N86-28701*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL ACOUSTIC RESULTS OF TWO ROTOR MODELS WITH SEVERAL TIP DESIGNS
R. M. Martin and Andrew B. Connor Jul. 1986 191 p
(NASA-TM-87698; L-16081; NAS 1.15:87698) Avail: NTIS HC A09/MF A01 CSCL 20F

A three-phase research program has been undertaken to study the acoustic signals due to the aerodynamic interaction of rotorcraft main rotors and tail rotors. During the first phase, two different rotor models with several interchangeable tips were tested in the Langley 4- by 7-Meter Tunnel on the U.S. Army rotor model system. An extensive acoustic data base was acquired, with special emphasis on blade-vortex interaction (BVI) noise. The details of the experimental procedure, acoustic data acquisition, and reduction are documented. The overall sound pressure level (OASPL) of the high-twist rotor systems is relatively insensitive to flight speed but generally increases with rotor tip-path-plane angle. The OASPL of the high-twist rotors is dominated by acoustic energy in the low-frequency harmonics. The OASPL of the low-twist rotor systems shows more dependence on flight speed than the high-twist rotors, in addition to being quite sensitive to tip-path-plane angle. An integrated band-limited sound pressure level, limited by 500 to 3000 Hz, is a useful metric to quantify the occurrence of BVI noise. The OASPL of the low-twist rotors is strongly influenced by the band-limited sound levels, indicating that the blade-vortex impulsive noise is a dominant noise source for this rotor design. The midfrequency acoustic levels for both rotors show a very strong dependence on rotor tip-path-plane angle. The tip-path-plane angle at which the maximum midfrequency sound level occurs consistently decreases with increasing flight speed. The maximum midfrequency sound level measured at a given location is constant regardless of the flight speed. Author

N86-28702*# Pennsylvania State Univ., University Park. Dept. of Physics.
EXPERIMENTAL STUDY USING NEARFIELD ACOUSTIC HOLOGRAPHY OF SOUND TRANSMISSION THROUGH FUSELAGE SIDEWALL STRUCTURES Final Report
J. D. Maynard 1986 70 p
(Grant NAG1-216)
(NASA-CR-177162; NAS 1.26:177162) Avail: NTIS HC A04/MF A01 CSCL 20A

The reduction of cabin noise in lightweight, propeller-driven aircraft is an especially difficult problem in noise control. Nearfield Acoustic Holography (NAH) was used to determine the mode of vibration and acoustic intensity for panels which differed in: construction (number of stiffening ribs, size of stifening ribs, construction material, and panel surface curvature); boundary

support condition (free edge condition or clamped edge condition); and mode of excitation (structural-borne forces or airborne forces). The different samples of aircraft panels are described and the measurement of the natural response frequencies was discussed under various boundary support and excitation conditions. The results of the NAH measurements are presented. B.G.

N86-28703# Colorado School of Mines, Golden. Center for Wave Phenomena.
ON THE IMAGING OF REFLECTORS IN THE EARTH
Norman Bleistein 15 Jan. 1986 78 p
(Contract N00014-84-K-0049)
(AD-A165638; CWP-038) Avail: NTIS HC A05/MF A01 CSCL 20/1

This paper is based on a paper by Beylkin in which a leading order asymptotic theory for inversion of acoustic data is presented. The method is based on earlier work by Beylkin in the theory of pseudo-differential operators and generalized back projections or Radon transforms. The back projection or inversion is carried out with respect to a general C(x,y,z) background sound speed. GRA

N86-28704# European Space Agency, Paris (France).
SCATTERING OF AN ACOUSTIC FIELD BY A NONHOMOGENEOUS, NONUNIFORM FLOW
Alain Guedel Nov. 1985 225 p Transl. into ENGLISH from "Diffusion dun Champ Acoustique par un Ecoulement Inhomogene et Non Uniforme" Chatillon, France Original language document was announced as N86-181127
(ESA-TT-935; ONERA-P-1985-1; ESA-86-96854) Avail: NTIS HC A10/MF A01

Scattering effects in an acoustic field propagated through the mixing region of an open jet were analyzed. For a monochromatic incident wave, the main effects are a broadening of the line at the emission frequency, with a modulation of the wave amplitude and phase. These processes were studied with a parametric analysis in wind tunnels having diameters of 2 and 3 m, and with models using Born and Rytov approximations. The experimental data are compared quantitatively with predictions from the theoretical analysis associated with an experimental model of the turbulence of the propagation medium. The study is applied to acoustic measurements carried out in an anechoic open-jet wind tunnel. ESA

N86-28705# Hochschule der Bundeswehr, Munich (West Germany). Inst. fuer Mechanik.
THE ACOUSTIC POWER OF CIRCULAR MEMBRANES [DIE AKUSTISCHE LEISTUNG KREISFOERMIGER MEMBRANEN]
Helmut Fleischer 1984 35 p In GERMAN
(Rept-4/84; ESA-86-96931) Avail: NTIS HC A03/MF A01

The acoustic power radiated by built-in circular membranes in a half space was calculated by numerical evaluation of the Huygens-Rayleigh integral for points on the surface. Approximation formulas for ka much smaller and much larger than one (k = wavenumber; a = outer radius) are given as well as diagrams in which the reactive and active power as a function of ka are shown for 20 natural shapes of vibration. As a possible application, from the natural shape - natural frequency spectra of given membranes, the accompanying acoustic power - frequency spectra can be determined from which auditory sensations such as loudness and pitch of tone can be obtained. ESA

N86-28706 United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
ACOUSTIC EMISSION-MICROSTRUCTURAL RELATIONSHIPS IN FERRITIC STEELS. PART 1: THE EFFECT OF COOLING RATE
H. N. G. Wadley and C. B. Scruby Jun. 1985 36 p
(AERE-R-11312) Copyright. Avail: Issuing Activity

Acoustic emission is controlled during deformation and fracture by the dynamics of dislocation motion and crack advance. The nature of the relationship between defect dynamics and acoustic emission in tensile samples of specially prepared low alloy steels containing 3.25 wt.% Ni, 1 wt.% Mn and a variable carbon content from 0.06 to 0.49 wt.% is studied. The most energetic signals are from microstructures with an initially low dislocation density and a ferrite dimension of approx. > 10 microns, indicating the propagation of high velocity dislocations in ferrite to be the origin of acoustic emission during deformation. This is consistent with a model in which the product of glide distance and velocity (which are both controlled by microstructure) determines the amplitude of the acoustic emission. During subcritical micro-fracture, intergranular and alternating shear modes of microcracking in high strength conditions generate detectable signals. Both involve the rapid growth of cracks over distances of 10 to 100 micron. The ductile dimple mode of fracture is found to generate no detectable signals despite wide variations in dimple spacing and fracture stress. This is consistent with the recognized view that such fracture occurs under essentially static conditions. Author

N86-28707 United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
ACOUSTIC EMISSION-MICROSTRUCTURAL RELATIONSHIPS IN FERRITIC STEELS. PART 2: THE EFFECT OF TEMPERING
C. B. Scruby and H. N. G. Wadley Jul. 1985 38 p
(AERE-R-11556-Pt-2) Copyright. Avail: Issuing Activity

Tempering of Fe-3.25 wt%Ni alloys with carbon contents of between 0.057 and 0.49 wt% leads to a pronounced acoustic emission activity during ambient temperature tensile testing. The maximum emission occurs from samples tempered approx. 250 deg C and appears only weakly influenced by carbon content. Mechanical property determinations link the maximum to a precipitation hardening effect. A model involving the cooperative motion of dislocations over distances corresponding to the lath-packet dimension is proposed. The mechanism responsible for cooperative motion is believed to be a precipitate shearing process, the first time such a process has been proposed for quenched and tempered ferritic steels. A second, much weaker source of emission has been identified in material subjected to prolonged tempering at 625 deg C. The mechanism responsible for this emission is believed to be the sudden multiplication and propagation of dislocations during microyield events. No evidence has been found to support the view that carbide fracture in quenched and tempered steels is a direct source of acoustic emission. The microstructural states in which most quenched and tempered steels are used in practice, generate very little detectable acoustic emission either during deformation or fracture, irrespective of carbon content. Author

N86-28228# California Inst. of Tech., Pasadena.
COUPLED VORTEX SHEDDING AND ACOUSTIC RESONANCES IN A DUCT
K. M. Aaron and F. E. C. Culick *In* Johns Hopkins Univ. The 22nd JANNAF Combustion Meeting Oct. 1985 p 161-171 (For primary document see N86-28212 19-28)
(Grant AF-AFOSR-0286-84)
Avail: CPIA, Laurel, Md. 20707 HC $70.00 CSCL 21/2

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-28708# Materials Quality Assurance Directorate, London (England). Materials Center.
SOME APPLICATIONS OF FAST ATOM BOMBARDMENT MASS SPECTROMETRY
J. Hodson and A. J. Pidduck Aug. 1985 26 p
(MQAD-TP-905; BR98163; ESA-86-97107) Avail: NTIS HC A03/MF A01

The fast atom bombardment (FAB) ionization source for mass spectrometry (MS) is introduced, and the advantages over other ionization techniques are discussed. Experimental factors are described. Applications of FABMS to the direct analysis of lubricant additives, thermally labile or involatile organic compounds such as

macromolecules and tonic dyestuffs, and inorganic compounds are outlined. The high specificity of FABMS for surfactant species difficult to analyze by other methods is emphasized. ESA

N86-28709*# National Aeronautics and Space Administration, Washington, D.C.
THE ROLE OF SPINNING ELECTRONS IN PARAMAGNETIC PHENOMENA
D. M. Bose Jun. 1986 27 p Transl. into ENGLISH from Zeitschrift fuer Physik (West Germany), v. 43, no. 8, 1927 p 864-882 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NAS2-4005)
(NASA-TM-88439; NAS 1.15:88439) Avail: NTIS HC A02/MF A01 CSCL 20H

An attempt is made to explain paramagnetic phenomena without assuming the orientation of a molecule or ion in a magnetic field. Only the spin angular momentum is assumed to be responsible. A derivative of the Gurie-Langevin law and the magnetic moments of ions are given as a function of the number of electrons in an inner, incomplete shell. An explanation of Gerlach's experiments with iron and nickel vapors is attempted. An explanation of magnetomechanical experiments with ferromagne elements is given. Author

N86-28710# California Univ., Berkeley. Dept. of Chemistry.
THE INFRARED MULTIPHOTON DISSOCIATION OF THREE NITROLKANES
A. M. Wodtke, E. J. Hintsa, and Y. T. Lee 24 Jan. 1986 61 p
(Contract N00014-83-K-0069)
(AD-A165605) Avail: NTIS HC A04/MF A01 CSCL 07/4

Infrared multiphoton dissociation in a molecular beam has been studied in order to elucidate the collision free, 'thermal' chemistry and dynamics of nitromethane, nitroethane and 2-nitropropane. The isomerization of CH3NO2 to CH3ONO was observed by detecting the CH3O and NO products from the dissociation of the very internally hot, isomerized nitromethane. A novel application of RRKM theory was used to estimate the barrier height to isomerization at 55.5 kcal/mol. The barrier height determination method was tested and found to give excellent results by applying it to the determintaion of the barrier height to HONO elimination from nitroethane, a value which is well known from activation energy measurements. The method was then applied to the case of HONO elimination from 2-nitropropane and it appears that there is good to believe that the barrier height is 3-5 kcal/mol lower in 2-nitropropane than in nitroethane. The success of this method for determining barrier heights shows how a microscopic molecular beam experiment, using infrared multiphoton dissociation where the concept of temperature has no place, can be quantitatively related to pyrolysis experiments which are conducted under collisional, thermal conditions and measure phenomenological quantities such as activation energies. GRA

N86-28711# Louisiana State Univ., Baton Rouge.
SEARCH FOR THE FORMATION OF THE QUARK-GLUON PLASMA BY MEASUREMENT OF CROSS SECTIONS FOR DIRECT PHOTONS AND LEPTONS Annual Progress Report, 1 Apr. 1985 - 31 Mar. 1986
P. N. Kirk Dec. 1985 12 p
(Contract DE-AS05-76ER-04699)
(DE86-004471; DOE/ER-04699/9) Avail: NTIS HC A02/MF A01

The VAX 11/750 computer system for data analysis is described. The design and construction details of multiwire proportional counters are given. DOE

N86-28712# Pacific Northwest Lab., Richland, Wash.
PROCEEDINGS OF THE WORKSHOP ON RADIATION SURVEY INSTRUMENTS AND CALIBRATIONS
J. M. Selby, K. L. Swinth, E. J. Vallario, and B. L. Murphy Nov. 1985 474 p Workshop held in Gaithersburg, Md., 10 Jul. 1984
(Contract DE-AC06-76RL-01830)
(DE86-005525; PNL-SA-13346; CONF-840774) Avail: NTIS HC A20/MF A01

The workshop was held to discuss two topics: (1) a performance standard for radiation survey instruments and the potential for a testing program based on that standard; and (2) a system of secondary standards laboratories to provide instrument calibrations and related services. Separate abstracts have been prepared for the individual presentations. DOE

N86-28713# Purdue Univ., West Lafayette, Ind. Dept. of Physics.
STUDY OF NUCLEAR CHARGE DISTRIBUTIONS BY MUONIC X-RAYS Final Report, 1 Jun. 1974 - 28 Feb. 1985
R. M. Steffen Nov. 1985 43 p
(Contract DE-AC02-76ER-02875)
(DE86-005127; DOE/ER-02875/20; COO-2875-20) Avail: NTIS HC A03/MF A01

Determination of the electric monopole and quadrupole properties (isomer shifts, quadrupole moments, B(E2) moments, etc.) of the low-lying state of nuclei in the transition regions is reported. In regions of nuclear shape transitions, measurements of the quadrupole moments of the first excited nuclear states of even-even nuclei through dynamic hyperfine interactions with muonic states are reported. Investigations on isotope and isomic shifts in the mass region from A = 40 to A= 150 are reported. Observation of static nuclear hexadecopole moments through hyperfine splittings in muonic d (5/2), f and g states in the uranium region are given. Investigation of anomalous widths in pionic 4f-3d transitions in the mass region around A = 170 are reported for Na, Ta, Pb and Bi. DOE

N86-28714# Virginia Univ., Charlottesville.
GLOW DISCHARGE AS AN ATOMIZATION AND IONIZATION SOURCE Progress Report
1986 7 p
(Contract DE-AS05-80ER-10635)
(DE86-005421; DOE/ER-10635/5) Avail: NTIS HC A02/MF A01

This progress report will summarize the activities in our laboratory over the past 12 months. Included are what we feel are the most important developments. Three separate, although complementary, projects form the foundation of our research at Virginia: (1) the hollow cathode plume; (2) resonance ionization mass spectrometry; and (3) glow discharge mass spectrometry. DOE

N86-28715# Argonne National Lab., Ill.
PROCEEDINGS OF THE WORKSHOP ON SOME ASPECTS OF AUTOIONIZATION IN ATOMS AND SMALL MOLECULES
J. Berkowitz, ed., H. G. Berry, ed., and R. S. Berry, ed. Nov. 1985 280 p Presented at the Workshop on Autoionization of Atoms and Small Molecules, Argonne, Ill., 2 May 1985 Prepared in cooperation with Chicago Univ., Ill.
(Contract W-31-109-eng-38)
(DE86-005521; ANL-PHY-85-3; CONF-850560) Avail: NTIS HC A13/MF A01

Do we really understand the phenomenon of autoionization in atoms sufficiently well to consider it a mature topic? Can we generalize our understanding to predict behavior in systems not yet studied? Can we extract physical understanding from the encouraging results of the many-body calculations? Or must we still try to understand one atom at a time? Molecular autoionization is clearly more difficult. Not only must we contend with vibrational autoionization as well as electronic autoionization, but the competing process of predissociation must also be taken into account. In this molecular domain, we have many experiments and many phenomena. The extant theories only deal with some cases, and are not yet able to explain some prominent observations. A group consisting of theorists and experimentalists active in the field of autoionization assembled at Argonne National Laboratory for a two-day Workshop on May 2 to 3, 1985, to try to provide some consensus of our present understanding and to point out the most promising direction for progress in the near future. Individual items from the workshop were prepared separately for the data base. DOE

N86-28716# Brookhaven National Lab., Upton, N. Y.
METHOD OF GENERATING INTENSE NUCLEAR POLARIZED BEAMS BY SELECTIVE PHOTODETACHMENT OF NEGATIVE IONS
A. Hershcovitch 1986 8 p Presented at the International Workshop on Polarized Sources and Targets, Montana, Switzerland, 13 Jan. 1986
(Contract DE-AC02-76CH-00016)
(DE86-005815; BNL-37519; CONF-860126-2) Avail: NTIS HC A02/MF A01

A novel method for production of nuclear polarized negative hydrogen ions by selective neutralization with a laser of negative hydrogen ions in a magnetic field is described. This selectivity is possible since a final state of the neutralized atom, and hence the neutralization energy, depends on its nuclear polarization. The main advantages of this scheme are the availability of multi-ampere negative ion sources and the possibility of neutralizing negative ions with very high efficiency. An assessment of the required laser power indicates that this method is in principle feasible with today's technology. DOE

N86-28717# Brown Univ., Providence, R. I. Dept. of Chemistry.
INTERACTIONS OF MOLECULES WITH SURFACES Progress Report, 1 Feb. 1985 - 31 Jan. 1986
E. F. Greene Jan. 1986 10 p
(Contract DE-FG02-85ER-13441)
(DE86-006512; DOE/ER-13441/1; COO-4974-8) Avail: NTIS HC A02/MF A01

The angular distributions of beams of Ne and Ar atoms scattered nearly elastically from LiF (100) at 294 K show structure that is obscured by inelastic scattering when the whole range of velocities leaving the crystal is recorded. Increased fluxes of neutral species in beams from an effusive source of alkali halide vapor observed when a beam of electrons is coaxial with the neutral beam are shown to be well accounted for by a model involving electron stimulated desorption of alkali atoms. A simple model is proposed for the compensation observed for changes of the preexponential factor and activation energy in rate coefficients for the desorption of molecules from surfaces undergoing surface phase transitions. The isomerization of perfluoroDewarbenzene to perfluorobenzene can be produced in yields of 10% after single energetic collisions with a surface of polytetrafluoroethylene. The yield of ions produced when a beam of Na atoms strikes a Si(111) surface is increased over the equilibrium value observed for thermal beams by a factor of 10 or more when the kinetic energy of the incomin g atoms is increased to 14 eV. The yield is sensitive to the dynamics of electron exchange between the surface and the ion. DOE

N86-28718# Stockholm Univ. (Sweden). Inst. of Physics.
FROM TRACKS ON FILM TO CORRECTED MULTIPLICITY DISTRIBUTIONS
Barbro Aasman Aug. 1985 67 p
(USIP-85-17; ESA-86-97046) Avail: NTIS HC A04/MF A01

Charged multiplicity distributions for the inelastic, non single-diffractive component of p bar p reactions at 540 GeV are given in full phase space and also in limited parts of phase space with cuts made in pseudorapidity. The method used to get the corrected multiplicity distribution is described. The data were obtained in streamer chambers. ESA

N86-28719# Stockholm Univ. (Sweden). Inst. of Physics.
MAXIMUM LIKELIHOOD FIT OF HADRONIC BACKGROUND IN THE 1982 BIG EUROPEAN BUBBLE CHAMBER (BEBC) BEAM DUMP EXPERIMENTER
K. Hultquist Oct. 1985 18 p
(USIP-85-21; ESA-86-97050) Avail: NTIS HC A02/MF A01

Neutrino-copper target interactions were studied. A method which estimates the neutrino signal in the neutral current (NC) sample with errors that agree with the Poisson error for high energies where the background is small is presented. Comparing the fit to data with fits to Monte Carlo samples generated using the fitted model gives a goodness-of-fit of 0.45. The Monte-Carlo fit results for the neutrino signal compared with the true signal generated show that there is no appreciable systematic shift, and that the errors are correctly determined. Correction to the raw NC sample is (2 + or - 4)% above 10 GeV hadronic energy. ESA

N86-28720# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
REVIEW OF THE CONVERSION COEFFICIENTS BETWEEN DOSIMETRIC QUANTITIES AND THOSE ESTABLISHED BY INTERNATIONAL COMMISSION ON RADIATION UNITS (ICRU)
A. Bartolotta 30 Sep. 1985 26 p In ITALIAN; ENGLISH summary Presented at ICRU Study Day on Determination of Dose Equivalents Resulting from External Radiation Sources, Rome, Italy, 21 Jun. 1985
(ISS-L-85/3; ISSN-0390-6493; ICRU-39; ESA-86-97080) Avail: NTIS HC A03/MF A01

Methods used to calculate radiation quantities are reviewed. Analysis of the conversion coefficients given by the methods shows that the errors are small enough to allow the application to radiation protection procedures. The remaining problems such as obtaining reference dosimetric values and the choice of adequate instrumentation to determine the new parameters are discussed. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-28721*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSPORT MODEL OF NUCLEON-NUCLEUS REACTION
John W. Wilson, Lawrence W. Townsend, and Francis A. Cucinott Jul. 1986 17 p
(NASA-TM-87724; NAS 1.15:87724) Avail: NTIS HC A02/MF A01 CSCL 20H

A simplified model of nucleon-nucleus reaction is developed and some of its properties are examined. Comparisons with proton production measured for targets of Al-27, Ni-58, Zr-90, and Bi-209 show some hope for developing an accurate model for these complex reactions. It is suggested that binding effects are the next step required for further development. Author

N86-28722# Clemson Univ., S.C.
ATF NEUTRAL BEAM INJECTION: OPTIMIZATION OF BEAM ALIGNMENT AND APERTURING
R. N. Morris, R. H. Fowler, J. A. Rome, and T. J. Schlagel Dec. 1985 35 p
(Contract DE-AC05-84OR-21400)
(DE86-004638; ORNL/TM-9689) Avail: NTIS HC A03/MF A01

The application of the existing Impurity Study Experiment (ISX-B) neutral beam injectors for the Advanced Toroidal Facility (ATF) is studied. It is determined that with the practical considerations of beam aperturing, ATF vacuum vessel complexity, and realistic beam modeling, the power absorbed by the plasma will be approximately 57% of the extracted neutral beam power, which corresponds to an injected power of about 1.5 MW. By reducing the beam divergence to a 1° Gaussian distribution, the absorbed power could be increased to 93%. The power delivered to the plasma is found to be a strong function of the beam divergence but only a weak function of the beam focal length. Shinethrough can be a serious problem if very low density startups are necessary. Preliminary calculations indicate that there will be no excessive fast-ion losses. DOE

N86-28723# Pittsburgh Univ., Pa. Graduate School of Public Health.
INVESTIGATION OF SITING PARAMETERS FOR NEAR SURFACE DISPOSAL OF LOW-LEVEL NUCLEAR WASTE Final Report

W. R. Schell, A. L. Sanchez, and E. D. Thomas 15 Dec. 1985 84 p
(Contract DE-FG07-84ID-12509)
(DE86-005498; DOE/ID-12509/1) Avail: NTIS HC A05/MF A01

A study was initiated in April 1984 to evaluate actual problems associated with and to recommend improvements for near surface disposal of low-level radioactive wastes in the State of Pennsylvania and the humid Northeast. The results of field measurements showed some vertical transport of Cs and other fallout radionuclides in Pb dated peat cores from the unsaturated zone. Under the natural acid rain conditions (pH 4.0), the most mobile radionuclide, Cs, gave diffusion coefficients of 10 to 10 cm-/sec in the different organic rich soils. Both the upward and downward migration of radionuclides resulted from the hydrological cycle of evapotranspiration and precipitation which gave diffusive mixing of mobile radionuclides. The distribution coefficient, K sub d values, for several radionuclides in the organic rich soils were found to be equal to or greater than those measured previously for inorganic clay and sediment matrices. To insure that radionuclides do not enter water supplies in the humid Northeast where pH 4.0 rain is encountered, a peat liner should be considered i n the multibarrier design of repositories. DOE

N86-28724# Netherlands Energy Research Foundation, Petten.
FUSION TECHNOLOGY PROGRAM Semi-Annual Progress Report, Jan.-Jun. 1984
J. D. Elen, comp. Oct. 1985 63 p
(ECN-171; B8577048; ESA-86-97018) Avail: NTIS HC A04/MF A01

System and safety studies for fusion reactors; nuclear data bases for fusion reactors; neutronic calculations for the Joint European Torus and B-2 fusion reactors; radiation damage of vanadium alloys and stainless steel; a facility for in-pile crack growth measurement; a niobium-tin magnet for the SULTAN stage 2; a NET conductor; ceramic breeder materials; and system studies for NET-TF coils are discussed. ESA

N86-28725# Netherlands Energy Research Foundation, Petten.
FUSION TECHNOLOGY PROGRAM Semi-Annual Progress Report, Jul.-Dec. 1984
J. D. Elen, comp. Nov. 1985 78 p
(ECN-177; B8578302; ESA-86-97020) Avail: NTIS HC A05/MF A01

System and safety studies for fusion reactors; nuclear data bases for fusion reactors; neutronic calculations for the Joint European Torus and B-2 fusion reactors; radiation damage of vanadium alloys and stainless steel; a facility for in-pile crack growth measurement; a niobium-tin magnet for the SULTAN stage 2; a Net conductor; ceramic breeder materials; and system studies for NET-TF coils are discussed. ESA

N86-28726# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
THE COSIMA EXPERIMENTS AND THEIR VERIFICATION, A DATA BASE FOR THE VALIDATION OF TWO PHASE FLOW COMPUTER CODES
G. Class, R Meyder, and E. Stratmanns Dec. 1985 205 p In GERMAN; ENGLISH summary
(KfK-4002; ISSN-0303-4003; ESA-86-96913) Avail: NTIS HC A10/MF A01

The large data base for validation and development of computer codes for two-phase flow, generated at the COSIMA facility, is reviewed. The aim of COSIMA is to simulate the hydraulic, thermal, and mechanical conditions in the subchannel and the cladding of fuel rods in pressurized water reactors during the blowout phase of a loss of coolant accident. In terms of fuel rod behavior, it is found that during blowout under realistic conditions only small strains are reached. For cladding rupture extremely high rod internal pressures are necessary. The behavior of fuel rod simulators and the effect of thermocouples attached to the cladding outer surface are clarified. Calculations performed with the codes RELAP and DRUFAN show satisfactory agreement with experiments. This can be improved by updating the phase separation models in the codes. ESA

N86-28727# Brookhaven National Lab., Upton, N. Y.
EXTENDED STORAGE OF LOW-LEVEL RADIOACTIVE WASTE: POTENTIAL PROBLEM AREAS
B. Siskind, D. R. Dougherty, and D. R. MacKenzie Dec. 1985 145 p
(Contract NRC-FIN-A-3171)
(TI86-004888; NUREG/CR-4062) Avail: NTIS HC A07/MF A01

If a state or state compact does not have adequate disposal capacity for low-level radioactive waste (LLRW) by 1986 as required by the Low-Level Waste Policy Act, then extended storage of certain LLRW may be necessary. Extended storage of LLRW is considered in order to determine for the Nuclear Regulatory Commission areas of concern and actions recommneded to resolve these concerns. The focus is on the properties and performance of the waste form and waste container. Storage alternatives are considered in order to characterize the likely storage environments for these wastes. The areas of concern about extended storage of LLRW are grouped into two categories: (1) performance of the waste form and/or container during storage, e.g., radiolytic gas generation, radiation-enhanced degradation of polymeric materials, and corrosion; and the (2) effects of extended storage on the properties of the waste form and/or container that are important after storage (e.g., radiation-induced embrittlement of high-density polyethylene and the weakening of steel containers resulting from corrosion). A discussion is given of additional information and actions required to address these concerns. Author

74 OPTICS

Includes light phenomena.

N86-28728*# National Aeronautics and Space Administration, Washington, D.C.
DYNAMIC METHOD FOR MEASURING THE NON-LINEARITIES OF PHOTOELECTRIC DETECTORS
H. J. Jung Jun. 1986 16 p Transl. into ENGLISH from Zeitschrift fuer Angewandte Physik (West Germany), v. 30, no. 5, 1970 p 338-341 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88464; NAS 1.15:88464) Avail: NTIS HC A02/MF A01 CSCL 20F

The photocurrent of a nonlinear radiation detector contains a signal with the frequency omega sub 1-omega sub 2 when exposed to two chopped light beams with the chopper frequencies omega sub 1 and omega sub 2. The amplitude of the intermodulation signal is proportional to the non-linearity. So it is possible to measure nonlinearities in a direct way without evaluating small differences of large quantities. The method shown requires less stability of light sources than classical methods. A dependence of the intermodulation signal on the chopper frequencies gives additional information about time dependent nonlinearities. Author

N86-28729*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
1700 DEG C OPTICAL TEMPERATURE SENSOR Final Report
P. W. Mossey, W. M. Shaffernocker, and A. R. Mulukutla Jul. 1986 168 p
(Contract NAS3-24085)
(NASA-CR-175108; NAS 1.26:175108; R86AEB267) Avail: NTIS HC A08/MF A01 CSCL 20F

A new gas temperature sensor was developed that shows promise of sufficient ruggedness to be useful as a gas turbine temperature sensor. The sensor is in the form of a single-crystal aluminum oxide ceramic, ground to a cone shape and given an emissive coating. A lens and an optical fiber conduct the thermally emitted light to a remote and near-infrared photodetector assembly.

Being optically coupled and passive, the sensor is highly immune to all types of electrical interference. Candidate sensors were analyzed for optical sensor performance, heat transfer characteristics, stress from gas loading. This led to the selection of the conical shape as the most promising for the gas turbine environment. One uncoated and two coated sensing elements were prepared for testing. Testing was conducted to an indicated 1750 C in a propane-air flame. Comparison with the referee optical pyrometer shows an accuracy of + or - 25 C at 1700 C for this initial development. One hundred cycles from room temperature to 1700 C left the sapphire cone intact, but some loss of the platinum, 6% rhodium coating was observed. Several areas for improving the overall performance and durability are identified.
Author

N86-28730*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMPLE ANTIREFLECTION OVERCOAT FOR OPAQUE COATINGS IN THE SUBMILLIMETER REGION
Sheldon M. Smith Apr. 1986 23 p Prepared for presentation at the SPIE Annual Meeting, 17-23 Aug. 1986
(NASA-TM-88219; A-86074; NAS 1.15:88219) Avail: NTIS HC A02/MF A01 CSCL 20F

An antireflection overcoat for opaque baffle coatings in the far infrared (FIR)/submillimeter region was made from a simple Teflon spray-on lubricant. The Teflon overcoat reduced the specular reflectance of four different opaque coatings by nearly a factor of two. Analysis, based on the interference term of a reflecting-layer model, indicates that in the submillimeter region the reduced reflectance depends primarily on the refractive index of the overcoat and very little on its thickness.
Author

N86-28731*# Howard Univ., Washington, D. C. Dept. of Electrical Engineering.
A CLASS OF OPTICALLY CONTROLLED MILLIMETER WAVE DEVICES Final Report, 1 Feb. 1985 - 30 Jun. 1986
Raj Chowdhary Jul. 1986 36 p
(Grant NAG5-390)
(NASA-CR-177178; NAS 1.26:177178) Avail: NTIS HC A03/MF A01 CSCL 20F

Three specific devices were investigated: the sheet resistance device, the Schottky-barrier diode and the PIN diode. Several sheet resistance devices were fabricated and tested. Based on the encouraging results from these devices, a mask was designed and sent to a vendor and is expected to be received very soon. A set of masks for fabricating transparent cathode Schottky-barrier diodes was designed. These masks were given to NASA Goddard Space Flight Center for fabrication of the diodes. A mask set was designed to fabricate PIN diodes with transparent electrodes. With slight modifications, the same mask set also can be used to fabricate other devices, such as MESFET and the IMPATT diode.
Author

N86-28732* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WIDE-ANGLE FLAT FIELD TELESCOPE Patent
Kenneth L. Hallam, Barton J. Howell, and Mark E. Wilson Issued 8 Jul. 1986 7 p Filed 5 Feb 1985 Supersedes N85-20868 (23 - 11, p 1728)
(NASA-Case-GSC-12825-1; US-Patent-4,598,981;
US-Patent-Appl-SN-698641; US-Patent-Class-350-505;
US-Patent-Class-350-276R; US-Patent-Class-354-479;
US-Patent-Class-358-222) Avail: US Patent and Trademark Office CSCL 20F

Described is an unobscured three mirror wide angle telescopic imaging system comprised of an input baffle which provides a 20 deg (Y axis) x 30 deg (X axis) field of view, a primary mirror having a convex spherical surface, a secondary mirror having a concave ellipsoidal reflecting surface, a tertiary mirror having a concave spherical reflecting surface. The mirrors comprise mirror elements which are offset segments of parent mirrors whose axes and vertices commonly lie on the system's optical axis. An iris diaphragm forming an aperture stop is located between the secondary and tertiary mirror with its center also being coincident with the optical axis and being further located at the beam waist of input light beams reflected from the primary and secondary mirror surfaces. At the system focus following the tertiary mirror is located a flat detector which may be, for example, a TV imaging tube or a photographic film. When desirable, a spectral transmission filter is placed in front of the detector in close proximity thereto.
Official Gazette of the U.S. Patent and Trademark Office

N86-28733# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
DEVELOPMENT OF FIBER OPTIC SYSTEMS FOR RECORDING AND TRANSMITTING HOLOGRAPHIC INFORMATION Final Report, 1 Sep. 1984 - 1 Dec. 1985
John A. Gilbert 1 Feb. 1986 18 p
(Contract DAAG29-84-K-0183)
(AD-A165710; ARO-21671.5-EG) Avail: NTIS HC A02/MF A01 CSCL 17/2

The overall aim of the work was to design and test self-contained, automated, fiber-based optical systems to measure displacement in production-related or dynamic testing applications. To this end, stability requirements imposed on fibers and optical elements required for remote holographic interferometric analysis have been evaluated for continuous wave laser systems, and techniques were developed to record interferograms on non-isolated and submerged test objects. Thermoplastics have been incorporated into fiber-based systems to record time-average and real-time holograms, and holographic/fiber-optic systems have been practically applied to evaluate the thermal deformation response of microcircuit modules.
GRA

N86-28734# New Mexico Univ., Albuquerque. Inst. for Modern Optics.
SOLITONS IN STIMULATED RAMAN SCATTERING: GENERATION AND CONTROL OF ULTRASHORT OPTICAL PULSES Final Report
Kai J. Druhl Feb. 1986 25 p
(Contract DAAG29-85-K-0031)
(AD-A165744; ARO-21497.2-PH) Avail: NTIS HC A02/MF A01 CSCL 20/6

A numerical and analytical study of soliton propagation and generation in a Raman amplifier is performed. Parameters are amplitude and temporal profile of input optical fields, Raman line width and detuning. Soliton excitations will develop, if a phase shift of nearly 180 degrees is introduced into the Stokes seed beam. In the absence of detuning and for an instantaneous phase shift of exactly 180 degrees the solitons will be stable. In the presence of detuning and for non instantaneous phase shifts of less than 180 degrees the solitons will be unstable and decay for sufficiently large gain. Limiting values are about 10% detuning relative to the Raman line width, and a fractional, unshifted Stokes intensity of about 1%. Stable solitons will show temporal narrowing with a width inversely proportional to the square root of the total gain. For large gain the final width is independent of the initial width. Unstable solitons will reach minimal width at a relative amplitude of .5, and begin to broaden on further propagation. The minimal width is proportional to the initial width and the initial relative amplitude.
GRA

N86-28735# Oak Ridge National Lab., Tenn.
TRANSMISSION MEASUREMENTS OF SELECTED LIQUIDS IN THE FAR INFRARED
M. A. Walker, R. K. Richards, and D. P. Hutchinson Nov. 1985 12 p
(Contract DE-AC05-84OR-21400)
(DE86-004641; ORNL/TM-9772) Avail: NTIS HC A02/MF A01

Measurements were taken of the transmission of 0.119 mm radiation through 22 liquids using a variable length absorption cell. Seven of these liquids were then selected to be tested at wavelengths of 0.185 mm, 0.307 mm, and 0.447 mm. It was found that a light grade of mineral oil proved to have excellent transmission in the far-infrared (FIR) spectrum. We were able,

from the data collected, to estimate the index of refraction of these liquids at wavelengths longer than 0.3 mm. DOE

N86-28736# Sandia National Labs., Albuquerque, N. Mex.
AUTOMATED LENS TESTING SYSTEM
R. O. Woods Dec. 1985 36 p
(Contract DE-AC04-76DP-00789)
(DE86-005783; SAND-85-2438) Avail: NTIS HC A03/MF A01

An autonomous, computer controlled system has been implemented to examine the optical field of non-imaging radiometer lenses. This report documents the software and also constitutes an operators's manual. DOE

N86-28737# Chicago Univ., Ill. Enrico Fermi Inst.
FUNDAMENTALS AND TECHNIQUES OF NONIMAGING OPTICS Progress Report
R. Winston Nov. 1985 20 p
(Contract DE-FG02-84ER-13178)
(DE86-005801; DOE/ER-13178/2) Avail: NTIS HC A02/MF A01

Work reported includes: generalized radiance and practical radiometry, construction of a conserved flux from plane waves, and formulation of a version of Liouville's theorem which is well suited for discussing the performace of optical systems in geometry. DOE

N86-28738# Connecticut Univ., Storrs.
ENERGY TRANSFER AND NON-LINEAR OPTICAL PROPERTIES AT NEAR ULTRAVIOLET WAVELENGTHS: RARE EARTH 4f->5d TRANSITIONS IN CRYSTALS AND GLASSES Progress Report, 1 Jun. 1985 - 31 May 1986
D. S. Hamilton Jan. 1986 43 p
(Contract DE-FG02-84ER-45056)
(DE86-006229; DOE/ER-45056/2) Avail: NTIS HC A03/MF A01

The project has considered several aspects of how high-fluence, near-ultraviolet laser light modifies the optical properties of cerium-doped crystals. Illumination of Ce^{3+}:CaF at 308 nm leads to a two-photon photoionization and the subsequent creation of photochromic color centers. A one-photon photobleaching of these centers and the finite electron acceptor density leads to a complex but solvable rate equation. The electron acceptors are trivalent cerium ions at quasi-cubic sites, which become divalent following the electron capture. The photo-bleaching involves the photoionization of the divalent cerium ions, with the electron returning to the original tetragonal symmetry site. Thermoluminescence measurements are used to study the thermally activated recombination radiation. Measurements of optical gain and loss in Ce^{3+}:LiYF are presented. DOE

N86-28739# Plessey Research (Caswell) Ltd., Towcester (England). Allan Clark Research Center.
SUB-MILLIMETER (FAR I-R) HETERODYNE SPECTROMETER (DEMONSTRATION MODEL). PART 2: EXTENSION OF SPECTRAL ANALYSIS CAPABILITIES Final Report, Dec. 1983 - Jan. 1985
C. J. Groves-Kirby 1985 75 p
(Contract ESA-5557/83-NL-PR)
(CD-6501735-Pt-2; ESA-CR(P)-2161; ESA-86-96863) Avail: NTIS HC A04/MF A01

The spectrum analysis capabilities of a Bragg Cell Spectrum Analyzer were extended. In order to increase bandwidth to 1.0GHz (from 500MHz), increases in RF system bandwidth, and optical system bandwidth were necessary. The bulky, power consuming 2 mW He-Ne laser was replaced by a more compact, efficient semiconductor laser, and the optical assembly redesigned. A surface acoustic wave compressive receiver was used as high resolution processor to extend resolution to 50 kHz over 50 MHz bandwidth. Light scattering onto the photodiode array remains a problem. ESA

N86-28740# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Thermodynamik.
MICROPROCESSOR CONTROLLED OPTICAL MEASURING SYSTEM FOR LARGE MIRROR MODULES
Rainer Koehne, Erich Rach, and Franz Reich Oct. 1985 60 p In GERMAN; ENGLISH summary Report wil also be announced as translation (ESA-TT-984)
(DFVLR-FB-85-58; ISSN-0171-1342; ESA-86-96878) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 21.50

A microprocessor controlled contactless measuring system was developed in order to determine how the beam quality of mirrors influences the performance of solar plants with focusing collectors. The system was installed to investigate large flat and curved mirror surfaces (< or = 10 sq m). An algorithm to evaluate the measured data was derived. The very accurate method is based on laser ray tracing to determine the ripple and the deviations from the ideal contour which can be expressed as a root mean square value. Measurements on parabolic trough mirrors and heliostat segments yield rms values of 10 and 3.7 mrad, respectively. ESA

N86-28741# Societe Nationale Industrielle Aerospatiale, Paris (France).
MEASUREMENT TRANSMISSION BY MEANS OF OPTICAL FILTERS [TRANSMISSION DE MESURES PAR FILTRES OPTIQUES]
Claude Prevost 1986 24 p In FRENCH Submitted for publication
(SNIAS-861-430-104; ESA-86-97166) Avail: NTIS HC A02/MF A01

The modulation procedures for transmitting measurement results using an optical fiber are examined. The advantages of an optical transmission channel are pointed out. Direct intensity base band modulation, pulse frequency modulation, pulse width modulation, and frequency modulation are discussed. It is shown that frequency modulation is better regarding signal to noise ratios, linearity and differential gain, while base band modulation is poorest in all these concepts. But as it is also the least complex, base band modulation is interesting for average quality applications. ESA

N86-28742# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Meteorologische Fernerkundung.
VISIBILITY OF SIGNAL LIGHTS UNDER ATMOSPHERIC INFLUENCES
Gerhard H. Ruppersberg Oct. 1985 61 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-987)
(DFVLR-FB-85-63; ISSN-0171-1342; ESA-86-96883) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 19.50

The influence of atmospheric parameters on the transmission of light was studied. Visual ranges calculated from illuminance thresholds using Allard's law are only valid up to viewing angles of 0.116 mrad. At larger viewing angles neglecting an additional path radiance term results in considerably higher required intensities and much smaller visual ranges.Chromatical thresholds of luminance and illuminance must contain the path luminance in front of the signal light instead of background luminance. A background stop at small distances considerably reduces the required luminance of a signal light which can also have a neglibible influence depending on the dominant type to threshold. ESA

N86-28743# Bonn Univ. (West Germany). Inst. fuer Physik.
A MOBILE RECEPTION TELESCOPE FOR LIDAR MEASUREMENTS Thesis [EIN MOBILES EMPFANGSTELESKOP FUER LIDAR-MESSUNGEN]
Lothar Pfeifer Jul. 1984 42 p In GERMAN
(IR-84-27; ISSN-0172-8741; ESA-86-96932) Avail: NTIS HC A03/MF A01

The tasks of the receiver optics in sodium lidar experiments, and requirements for a measuring campaign instrument are discussed. The optical components are presented. The control system of the primary mirror of the telescope is described. For this control, the adjusting laser system was analyzed and optimized. A systematic measuring procedure for the primary mirror was

developed. The adjustment of the telescope using the preliminary adjustment of the secondary mirror is described. It is shown that mirror errors require a modification of the setup. The receiver lobe in measuring situations was calculated. Experience with the telescope during the campaign is summarized. The efficiency of the global receiver was calculated. Possibilities to improve the experiment are discussed. ESA

N86-28744# Berkeley Scientific Translation Service, Calif.
OPTICAL GLASS
T. S. Izumitani Oct. 1985 204 p Transl. into ENGLISH of unidentified Japanese report
(TI86-025776; UCRL-Trans-12065) Avail: NTIS HC A10/MF A01

Topics addressed include: physical and chemical properties of optical glass; manufacturing methods; cold working; polishing; coatings; laser glass; acousto-optic glass; delay-line glass; transparent crystallized glass; phase separation; glass transition; and vitreous state. B.G.

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-28745# Argonne National Lab., Ill.
COMPARISON OF TOKAMAK BURN CYCLE OPTIONS
D. A. Ehst, J. N. Brooks, Y. Cha, K. Evans, Jr., A. M. Hassanein, S. Kim, S. Majumdar, B. Misra, and H. C. Stevens 1985 22 p Presented at the Workshop on Tokamak Start-UP: Problems and Scenarios Related To the Transient Phases of Long-Burn Operations, Erice, Italy, 14 Jul. 1985
(Contract W-31-109-eng-38)
(DE85-018393; CONF-850708-4) Avail: NTIS HC A02/MF A01

Experimental confirmation of noninductive current drive has spawned a number of suggestions as to how this technique can be used to extend the fusion burn period and improve the reactor prospects of tokamaks. Several distinct burn cycles, which employ various combinations of Ohmic and noninductive current generation, are possible, and we will study their relative costs and benefits for both a commercial reactor as well as an INTOR-class device. We begin with a review of the burn cycle options. DOE

N86-28746# Missouri Univ., Rolla. Dept. of Physics.
COLLISIONAL PROCESSES OF INTEREST IN MFE PLASMA RESEARCH Annual Report, 1 Oct. 1984 - 30 Sep. 1985
R. E. Olson 25 Oct. 1985 13 p
(Contract DE-FG02-84ER-53175)
(DE86-004412; DOE/ER-53175/2) Avail: NTIS HC A02/MF A01

Research on this grant can be divided into three general topics: (1) determination of electron capture cross sections between impurity ions and hydrogen atoms needed for diagnostic studies of magnetic fusion plasmas; (2) studies into reactions important in neutral beam ion source work; and (3) calculation of cross sections relevant to alpha particle transport. For topic (1) during last year, we completed cross section calculations for Al^{3+}, Al^{3+}, B^{3+}, Be^{3+}, Cr^{6+}, Sc^{3+} and V^{5+} on H using the molecular state approach for energies between 50 eV/u and 10 keV/u. For ion source work, collisional studies were completed for nuclear spin exchange of hydrogen in collision with the alkali atoms and for H^- negative ion formation in collision of H^0 with sodium and cesium. During the same period, we began to develop theoretical methods to handle collisions of impurity ions with neutral helium. Studies of Ar^{6+}, C^{4+}, C^{6+}, H^+ and O^{6+} colliding with He were completed. DOE

N86-28747# Texas Univ., Austin.
EXISTENCE AND CALCULATION OF SHARP BOUNDARY MHD EQUILIBRIUM IN THREE-DIMENSIONAL TOROIDAL GEOMETRY
H. L. Berk, J. P. Freidberg, X. Llobet, P. J. Morrison, and J. A. Tataronis Nov. 1985 28 p
(Contract DE-FG05-80ET-53088)
(DE86-004563; DOE/ET-53088/216; IFSR-216) Avail: NTIS HC A03/MF A01

The problem of sharp boundary, ideal magnetohydrodynamic equilibria in three-dimensional toroidal geometry is addressed. The sharp boundary, which separates a uniform pressure, current-free plasma from a vacuum, is determined by a magnetic surface of a given vacuum magnetic field. The pressure balance equation has the form of a Hamilton-Jacobi equation with a Hamiltonian that is quadratic in the momentum variables, which are the two covariant components of the magnetic field on the outer surface of the plasma. The condition of finding a unique solution on the outer surface is identical with finding phase space tori in nonlinear dynamics problems and the KAM theorem guarantees that such solutions exist. When tori exist, renormalized perturbation theory is used to calculate the properties of the magnetic field just outside the plasma. DOE

N86-28748# Oak Ridge National Lab., Tenn.
EFFECTS OF AN ALPHA PARTICLE SLOWING-DOWN DISTRIBUTION ON TOKAMAK BALLOONING MODES
D. A. Spong, D. E. Hastings, D. J. Sigmar, and W. A. Cooper Dec. 1985 32 p
(Contract DE-AC05-84OR-21400)
(DE86-004647; ORNL/TM-9688) Avail: NTIS HC A03/MF A01

Energetic trapped alpha particles interact through their precessional drift with high-mode-number ballooning modes in tokamaks. Due to the energy dependence of the precessional drift, the consequences of this interaction depend on the form of the alpha distribution function. Results are compared here for two forms of alpha distribution: a Maxwellian and a slowing-down distribution. The latter has a significantly greater influence on ballooning stability because of the larger fraction of particles in the energy range of the drift resonance. Also, due to the dependence on the critical velocity (- T sub e sup 1/2), the stability boundaries and growth rates now are strong functions of the background electron temperature T sub e . Parameters typical of tokamak breakeven experiments such as the Tokamak Fusion Test Reactor (TFTR) are considered. DOE

N86-28749# Texas Univ., Austin. Inst. for Fusion Studies.
ELECTROMAGNETIC SOLITARY VORTICES IN ROTATING PLASMA
J. Liu and W. Horton Dec. 1985 36 p
(Contract DE-FG05-80ET-53088)
(DE86-005400; DOE/ET-53088/214; IFSR-214) Avail: NTIS HC A03/MF A01

The nonlinear equations describing drift-Alfven solitary vortices in a low , rotating plasma are derived. Two types of solitary vortex solutions along with their corresponding nonlinear dispersion relations are obtained. Both solutions have the localized coherent dilopar structure. The first type of solution belongs to the family of the usual Rossby or drift wave vortex, while the second type of solution is intrinsic to the electromagnetic perturbation in a magnetized plasma and is a complicated structure. While the first type of vortex is a solution to a second order differential equation the second one is the solution of a fourth order differential equation intrinsic to the electromagnetic problem. The fourth order vortex solution has two intrinsic space scales in contrast to the single space scale of the previous drift vortex solution. With the second short scale length the parallel current density at the vortex interface becomes continuous. As special cases the rotational electron drift vortex and the rotational ballooning vortex also are given. DOE

N86-28750# Oak Ridge National Lab., Tenn.
PHYSICS EVALUATION OF COMPACT TOKAMAK IGNITION EXPERIMENTS
N. A. Uckan, W. A. Houlberg, and J. Sheffield 1985 9 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003806; CONF-851102-49) Avail: NTIS HC A02/MF A01

At present, several approaches for compact, high-field tokamak

ignition experiments are being considered. A comprehensive method for analyzing the potential physics operating regimes and plasma performance characteristics of such ignition experiments with O-D (analytic) and 1-1/2-D (WHIST) transport models is presented. The results from both calculations are in agreement and show that there are regimes in parameter space in which a class of small (R(sub o) approx. 1-2 m), high-field (B(sub o) approx. 8-13 T) tokamaks with aB(sub o sup 2/q sub *approx. 25 + or - 5 and kappa = b/a approx. 1.6-2.0 appears ignitable for a reasonable range of transport assumptions. Considering both the density and beta limits, an evaluation of the performance is presented for various forms of chi(sub e) and chi(sub i), including degradation at high power and sawtooth activity. The prospects of ohmic ignition are also examined. DOE

N86-28751# GA Technologies, Inc., San Diego, Calif.
SURVEY OF ECH MICROWAVE TECHNOLOGY
C. P. Moeller Nov. 1985 18 p Presented at the Course and Workshop on Applications of RF Waves to Tokamak Devices, Varenna, Italy, 5 Sep. 1985
(Contract DE-AC03-84ER-51044)
(DE86-004265; GA-A-18150; CONF-8509192-4) Avail: NTIS HC A02/MF A01

A survey is presented of the microwave transmission system and antenna technology that has been developed for electron cyclotron heating (ECH) experiments using gyrotron sources. It is concerned particularly with techniques that have been applied or are applicable to the heating of tokamak plasmas. DOE

N86-28752# Argonne National Lab., Ill.
LIFETIME ANALYSIS OF PLASMA SIDE COMPONENTS
R. F. Mattas Nov. 1985 15 p Presented at the Technical Committee on Lifetime Predictions for the First Wall and Blanket Structure of Fusion Reactors, Karlsruhe, West Germany, 5 Nov. 1985
(Contract W-31-109-eng-38)
(DE86-005566; CONF-851183-1) Avail: NTIS HC A02/MF A01

A one-dimensional computer code (FLIP, Fusion Lifetime Prediction) has been developed to examine the lifetime of first wall and impurity control components. The code incorporates the operating and design parameters, the material characteristics, and the appropriate failure criteria for the individual components. The major emphasis of the modelling effort has been to calculate the temperature-stress-strain-radiation effects history of a component so that the synergistic effects between sputtering erosion, swelling, creep, fatigue, and crack growth can be examined. The general forms of the property equations are the same for all materials in order to provide the greatest flexibility for materials selection in the code. The code is capable of determining the behavior of a plate, composed of either a single or dual material structure, that is either totally constrained, or constrained from bending but not from expansion. The code has been utilized to analyze plasma side components for INTOR. DOE

N86-28753# Sandia National Labs., Albuquerque, N. Mex.
ADVANCES IN LIGHT ION BEAMS FOR INERTIAL CONFINEMENT FUSION
D. L. Cook, J. E. Maenchen, T. A. Mehlhorn, J. N. Olsen, T. J. Renk, C. L. Ruiz, R. Woodworth, J. P. Quintenz, S. A. Slutz, and R. J. Leeper 1985 20 p Presented at the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, Calif., 28 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-005634; SAND-85-1851C; CONF-851053-8) Avail: NTIS HC A02/MF A01

The development of the Particle Beam Fusion Accelerator (PBFA I) is discussed. Key issues in intense beam generation and focusing are stated to be: (1) accelerator symmetry; (2) ion source initiation; (3) ion source purity and species control; (4) diode impedance behavior and control; (5) beam neutralization and transport; (6) beam diagnostics; and (7) predictive theoretical tools. Discussions of these topics are included. DOE

N86-28754# Lawrence Livermore National Lab., Calif.
COMPUTATIONAL PHYSICS PROGRAM OF THE NATIONAL MFE COMPUTER CENTER
A. A. Mirin Dec. 1985 48 p
(Contract W-7405-eng-48)
(DE86-005762; UCID-17530-85) Avail: NTIS HC A03/MF A01

The development of numerical models for plasma phenomena and magnetic confinement devices is discussed. The multidimensional Fokker-Planck and transport codes are applied to toroidal mirror and compact toroid devices. Linear and nonlinear resistive magnetohydrodynamics in two and three dimensions are used in the investigation of various fusion devices. DOE

N86-28755# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
WEAK DOUBLE LAYERS IN A CURRENT CARRYING PLASMA
Staffan Torven Nov. 1985 17 p Presented at Nordic Symposium on Nonlinear Plasma Waves, Riso, Sweden, Aug. 1985 Submitted for publication
(TRITA-EPP-85-08; ISSN-0348-7539; ESA-86-97032) Avail: NTIS HC A02/MF A01

The existence of weak electric double layers in a current carrying low density plasma is investigated for an electron distribution function of interest in triple plasma devices and Q-machines in double ended operation. In these devices the electron distribution function in the central plasma may be discontinuous since it is made up of contributions from two independent plasma sources. A time evolution equation for a weak double layer for the case of cold ions and a discontinuous electron distribution function is derived. The existence of stationary solutions describing a propagating double layer is demonstrated, and the amplitude of the double layer is found to be proportional to the jump in the electron distribution function at the point of discontinuity. ESA

N86-28756# Kiruna Geophysical Inst. (Sweden).
WAVES WITH FREQUENCIES BELOW THE PROTON GYROFREQUENCY IN A MULTICOMPONENT PLASMA
Tord Oscarsson and Mats Andre May 1985 26 p Prepared in cooperation with Umeaa Univ., Sweden
(KGI-Preprint-080; ISSN-0349-2656; ESA-86-97045) Avail: NTIS HC A03/MF A01

Waves below the proton gyrofrequency in a homogeneous, nonrelativistic multicomponent plasma in a uniform magnetic field are investigated. It is found that the introduction of a heavier ion species into a proton-electron plasma can make the plasma become absolutely unstable more easily. It is shown that the effects of warm plasma on the propagation properties of the waves are neglected in a standard approximation and hence it gives erroneous results in absolutely unstable plasmas. The effects of warm plasma on the mode structure are examined. Most often the large scale structure is not affected, but there are cases where left-hand polarized waves are found in frequency ranges above a heavy ion gyrofrequency, where there is a stop band in the corresponding cool plasma. ESA

N86-28757# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
THE MHD POWER RADIATED BY A LARGE CONDUCTOR IN MOTION THROUGH A MAGNETOPLASMA
M. Dobrowolny Apr. 1985 24 p
(IFSI-85-4; ESA-86-97088) Avail: NTIS HC A02/MF A01

The theory of radiation from a conductor of finite dimensions in motion through a magnetoplasma is developed. The theory, as applied to magnetohydrodynamic frequencies, produces quantitatively the concept of Alfven wings. Estimates of power radiated in Alfven waves are revised, and a physical interpretation of the formal result is given. Results are applied to the case of long conducting tethers in motion through the ionosphere. For tethered satellites, low powers (1W) radiated into the ionosphere are predicted. ESA

N86-28758# Oak Ridge National Lab., Tenn.
DESIGN FEATURES OF THE ELMO BUMPY SQUARE
W. E. Bryan 1985 5 p Presented at conference
(Contract DE-AS05-84OR-21400)
(TI86-003811; CONF-851102-39) Avail: NTIS HC A02/MF A01

The ELMO Bumpy Square (EBS) is an improved version of a bumpy torus. The purposes of the experiment are: to improve the physics of confinement in toroidal systems by developing the concepts of stabilization of instabilities using the effects of energetic electron populations and reduction of thermal losses using magnetic and electric fields to control particle drifts, and to develop bumpy toroid devices as fusion reactor candidates attractive in their own right. Several advanced bumpy torus configurations were studied in detail to identify concepts that offer potential for enchanced performance over the ELMO BUMPY Torus (EBT) configuration and offer favorable reactor extrapolations. The bumpy square is the most suitable configuration to test in that it is a rebuilding, into a square geometry, of the existing EBT device and the only configuration that has attractive behavior both at the scale of EBT and at the reactor scale. The EBT is formed by four linear arrays of simple magnetic mirrors linked by the four high-field toroidal solenoid (corners). The configuration is such that the straight sides of the square are constructed from the existing EBT mirror coils (four coils per side), and each corner is formed by eight new half-size EBT coils that generate high fields with negligible field ripple in the corners. Author

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-28759*# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
THEORETICAL STUDY OF THE TRANSVERSE DIELECTRIC CONSTANT OF SUPERLATTICES AND THEIR ALLOYS Ph.D Thesis
Keith Brian Kahan Aug. 1986 95 p
(Grant NAG3-507)
(NASA-CR-177198; NAS 1.26:177198; UILU-ENG-86-2221) Avail: NTIS HC A05/MF A01 CSCL 20L

The optical properties of III to V binary and ternary compounds and GaAs-Al(x)Ga(1-x)As superlattices are determined by calculating the real and imaginary parts of the transverse dielectric constant. Emphasis is given to determining the influence of different material and superlattice parameters on the values of the index of refraction and absorption coefficient. In order to calculate the optical properties of a material, it is necessary to compute its electronic band structure. This was accomplished by introducing a partition band structure approach based on a combination of the vector k x vector p and nonlocal pseudopotential techniques. The advantages of this approach are that it is accurate, computationally fast, analytical, and flexible. These last two properties enable incorporation of additional effects into the model, such as disorder scattering, which occurs for alloy materials and excitons. Furthermore, the model is easily extended to more complex structures, for example multiple quantum wells and superlattices. The results for the transverse dielectric constant and absorption coefficient of bulk III to V compounds compare well with other one-electron band structure models and the calculations show that for small frequencies, the index of refraction is determined mainly by the contibution of the outer regions of the Brillouin zone. Author

N86-28760* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF MAKING MACROCRYSTALLINE OR SINGLE CRYSTAL SEMICONDUCTOR MATERIAL Patent
Paul J. Shlichta, inventor (to NASA) and R. James Holliday, inventor (to NASA) Issued 24 Jun. 1986 4 p Filed 10 Feb. 1983 Supersedes N83-21993 (21 - 11, p 1796)
(NASA-Case-NPO-15904-1; US-Patent-4,596,626; US-Patent-Appl-SN-465369; US-Patent-Class-156-610; US-Patent-Class-156-DIG.88; US-Patent-Class-156-624) Avail: US Patent and Trademark Office CSCL 20L

A macrocrystalline or single crystal semiconductive material is formed from a primary substrate including a single crystal or several very large crystals of a relatively low melting material. This primary substrate is deposited on a base such as steel or ceramic, and it may be formed from such metals as zinc, cadmium, germanium, aluminum, tin, lead, copper, brass, magnesium silicide, or magnesium stannide. These materials generally have a melting point below about 1000 C and form on the base crystals the size of fingernails or greater. The primary substrate has an epitaxial relationship with a subsequently applied layer of material, and because of this epitaxial relationship, the material deposited on the primary substrate will have essentially the same crystal size as the crystals in the primary substrate. If required, successive layers are formed, each of a material which has an epitaxial relationship with the previously deposited layer, until a layer is formed which has an epitaxial relationship with the semiconductive material. This layer is referred to as the epitaxial substrate, and its crystals serve as sites for the growth of large crystals of semiconductive material. The primary substrate is passivated to remove or otherwise convert it into a stable or nonreactive state prior to deposition of the seconductive material.
Official Gazette of the U.S. Patent and Trademark Office

N86-28761# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
THERMODYNAMICALLY STABLE METAL/III-V COMPOUND-SEMICONDUCTOR INTERFACES
R. S. Williams, Jeffrey R. Lince, C. T. Tsai, and John H. Pugh 28 Feb. 1986 8 p
(Contract N00014-83-K-0612)
(AD-A165597; TR-13) Avail: NTIS HC A02/MF A01 CSCL 07/4

Chemical reactions that occur at a metal/III-V compound-semiconductor interface should be minimized if the change in Gibbs free energy of the bulk materials with respect to any possible reaction products is positive. However, the large positive change in entropy caused by vaporization of the highly volatile group V elements is a very important contributicn to the Gibbs free energy of these systems, especially at higher temperatures. Thus, a particular metal/III-V compound-semiconductor interface may be thermodynamically stable at one temperature, but unstable with respect to sublimation of elemental group V species at a higher temperature if the enthalpy change for the reaction is positive. Examination of bulk phase diagrams makes it possible to rationalize the reaction products observed and to predict which will be the most stable interface for any particular metal/III-V system. GRA

N86-28762# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
SOLID STATE RESEARCH Quarterly Technical Report, 1 Feb. - 30 Apr. 1985
Alan L. McWhorter 15 May 1985 69 p
(Contract F19628-85-C-0002)
(AD-A165692; Rept-1985:; Rept-2; ESD-TR-85-214) Avail: NTIS HC A04/MF A01 CSCL 20/12

The topics covered are solid state device research, quantum electronics, materials research, microelectronics, and analog device technology. GRA

N86-28763# Massachusetts Inst. of Tech., Lexington.
InP MATERIALS Annual Technical Summary Report, 1 Oct. 1984 - 30 Sep. 1985
Gerald W. Iseler 30 Sep. 1985 31 p
(Contract F19628-85-C-0002)
(AD-A165706; ESD-TR-85-316) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report covers the work on InP materials carried out with the support of the Department of the Air Force during the period 1 October 1984 through 30 September 1985. A part of this support

was provided by the Rome Air Development Center. The probability of twinning in LEC growth of InP was found to be much higher for the <100> orientation that for the <111>. An optical absorption technique is being developed for estimating the residual impurity concentration in semi-insulating Fedoped InP. It has been shown that V in InP behaves as a deep donor located approx. 0.2 eV above the valence band. GRA

N86-28764# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
DIFFUSION AND DEFECT CHARACTERIZATION STUDIES OF MERCURY CADMIUM TELLURIDE Semiannual Progress Report, 1 Aug. 1985 - 31 Jan.
D. A. Stevenson 31 Jan. 1986 4 p
(Contract N00014-84-K-0423; ARPA Order 5019)
(AD-A165813) Avail: NTIS HC A02/MF A01 CSCL 20/2

During the last six month period, progress has continued on the two major areas of this program: diffusion studies in Mercury Cadmium Telluride (MCT); and growth studies in MCT. The diffusion studies have emphasized the question of multiple and distinct Hg profiles in self-diffusion and the Kirkendall effect for interdiffusion. The growth studies have concerned the relation between the surface morphology of epitaxial layers and the substrate orientation, the development of new Hg rich liquid phase epitaxial growth method, and a continuation of an electrochemical of thermodynamic properties of MCT and related binary compounds. GRA

N86-28765# Modena Univ. (Italy).
MONTE CARLO ANALYSIS OF QUANTUM TRANSPORT AND FLUCTUATIONS IN SEMICONDUCTORS Final Technical Report, Apr. 1983 - Jul. 1985
Carlo Jacoboni 18 Feb. 1986 146 p
(Contracts DAJA45-83-C-0039; DA Proj. 1T1-61102-BH-57)
(AD-A165843; R/D-4260-EE) Avail: NTIS HC A07/MF A01 CSCL 20/12

Technical matter related to research performed on two different subjects is presented. The first part concerns quantum transport in semiconductors. A unified review of the work already published in the literature is given together with some attempts to generalize Monte Carlo methods relating to quantum transport within the Liouville formulation. The second part concerns fluctuations of carrier velocities and energies both in stationary and transient regime, described by means of the correlation-function method. An analysis of the results, obtained through a Monte Carlo procedure, for covalent and polar materials yields a deep physical picture of the effect of the scattering mechanisms (phonon and carrier-carrier interactions) on transport properties. GRA

N86-28766# Los Alamos National Lab., N. Mex.
EFFECTIVE-CLUSTER SIMULATIONS OF POLYCRYSTAL PLASTICITY
U. F. Kocks, C. Tome, and G. R. Canova 1985 9 p Presented at the International Conference on Physical Basis and Modelling of Finite Deformation of Aggregates, Paris, France, 30 Sep. - 2 Oct. 1985
(Contract W-7405-eng-36)
(DE85-014081; LA-UR-85-2221; CONF-8509112-1) Avail: NTIS HC A02/MF A01

A model is proposed in which each grain, representative of a certain orientation and strength, is embedded in a thin shell of plastic effective medium; this assembly is called an effective cluster. For each grain the plastic strain increment is chosen such that the yield surface of the effective cluster gives the macroscopic stress. The results differ from uniform-strain theories only in some cases, such as in the compression of f. c. c. polycrystals, where grain curling occurs. DOE

N86-28767# California Univ., Berkeley. Lawrence Berkeley Lab.
GROWTH OF (110) GaAs/GaAs BY MOLECULAR BEAM EPITAXY
L. T. Parechanian, E. R. Weber, and T. L. Hierl Apr. 1985 9 p Presented at the Materials Research Society Spring Conference, San Francisco, Calif., 15-18 Apr. 1985
(Contract DE-AC03-76SF-00098)
(DE86-005215; LBL-19743) Avail: NTIS HC A02/MF A01

The simultaneous molecular beam epitaxy (MBE) growth of (100) and (110) GaAs/GaAs intentionally doped with Si(-1E16/cu cm) was studied as a function of substrate temperature, arsenic overpressure, and epitaxial growth rate. The films were analyzed by scanning electron and optical microscopy, liquid helium photoluminescence (PL), and electronic characterization. For the (110) epitaxial layers, an increase in morphological defect density and degradation of PL signal was observed with a lowering of the substrate temperature from 570 C. Capacitance-voltage (CV) and Hall effect measurements yield room temperature donor concentrations for the (100) films of n-7E15/ cu cm while the (110) layers exhibit electron concentrations of n-2E17/cu cm. Hall measurements at 77k on the (100) films show the expected mobility enhancement of Si donors, whereas the (110) epi layers become insulating or greatly compensated. This behavior suggests that room temperature conduction in the (110) films is due to a deeper donor partially compensated by an acceptor level whose concentration is of the smae order of magnitude as that of any electrically active Si. Temperature dependent Hall effect indicates that the activation energy of the deeper donor level lies -145 meV from the conduction band. Author

N86-28768# Argonne National Lab., Ill.
ION IMPLANTATION AT ELEVATED TEMPERATURES
N. Q. Lam and G. K. Leaf Nov. 1985 8 p Presented at the Materials Research Society Meeting. Boston, Mass., 2 Dec. 1985
(Contract W-31-109-eng-38)
(DE86-005537; CONF-851217-31) Avail: NTIS HC A02/MF A01

A kinetic model has been developed to investigate the synergistic effects of radiation-enhanced diffusion, radiation-induced segregation and preferential sputtering on the spatial redistribution of implanted solutes during implantation at elevated temperatures. Sample calculations were performed for Al(+) and Si(+) ions implanted into Ni. With the present model, the influence of various implantation parameters on the evolution of implant concentration profiles could be examined in detail. DOE

N86-28769# Argonne National Lab., Ill.
ELECTRICAL RESISTIVITY OF Au-Cr SUPERLATTICES
M. B. Brodsky, C. H. Sowers, and L. R. Sill Dec. 1985 6 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract W-31-109-eng-38)
(DE86-005539; CONF-851217-28) Avail: NTIS HC A02/MF A01

Superlattices of Au-Cr with Au:Cr = 2:1 have been prepared. Their electrical resistivities have been measured between 0.3 to 300 K. Whereas simple rho-T behavior was found for lambda = 30, 51, 90 and 150 A, complicated behavior similar to magnetic ordering is found for lambda = 45 A. No correlation is observed with the extremum wavelength for phonon velocities - a maximum occurs at 75 A - unlike that found for most metallic superlattices. DOE

N86-28770# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
IN-SITU STUDY OF CASCADE DEFECTS IN SILVER BY SIMULTANEOUS TRANSMISSION ELECTRON MICROSCOPY AND ELECTRICAL RESISTIVITY MEASUREMENTS AT LOW TEMPERATURES
K. Haga, W. E. King (Argonne National Lab., Ill.), K. L. Merkle, and M. Meshii Dec. 1985 32 p Presented at the TMS/AIME Fall Meeting, Toronto, Ontario, 13 Oct. 1985 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE86-005561; CONF-8510168-7) Avail: NTIS HC A03/MF A01

A helium-cooled double-tilt specimen stage for transmission electron microscopy (TEM) with the capability of simultaneous electrical resistivity measurements was constructed and used to study defect-production, migration, clustering and recovery processes in ion-irradiated silver. Vacuum-evaporated thin film

specimens were irradiated with 1 MeV Kr (+) -ions up to a dose of 4.0 x 10^{15} ions/cm^3, at T = 10°K in the microscope, using the HVEM-tandem accelerator ion beam interface system in the Argonne National Laboratory Electron Microscopy Center. Cascade defect formation during ion bombardment at the low temperature was directly observed both by TEM and electrical resistivity measurements. Ion bombardment created groups of defect clusters with strong strain fields which gave rise to TEM contrast. The specimen resistivity was increased by 16% during the irradiation. Subsequent microstructural changes and resistivity recovery during isochronal annealing were monitored up to room temperature. 58.3% of the irradiation induced resistivity was recovered, while significant reduction in the size of black spot defect clusters was observed by TEM. A small fraction of clusters disappeared, while no nucleation of new defect clusters was observed. DOE

N86-28771# Northwestern Univ., Evanston, Ill.
ELECTRONIC AND STRUCTURAL PROPERTIES OF SEMICONDUCTOR HETEROJUNCTIONS Technical Progress Report, 1 Jul. - 15 Dec. 1985
Y. W. Chung Dec. 1985 13 p
(Contract DE-FG02-85ER-45216)
(DE86-005707; DOE/ER-45216/T1) Avail: NTIS HC A02/MF A01

We successfully developed a procedure for preparation of clean, ordered and stoichiometric CdTe(110) single crystal surfaces. The stoichiometry was verified by polar-angle-resolved X-ray photoemission. Two evaporators were constructed permitting sequential metal (Sn, Ag or Al) and CdTe deposition in the same ultrahigh vacuum chamber. A preliminary run was performed on the deposition of 10 A gray Sn on CdTe. Angle-resolved photoemission showed that the Sn/CdTe interface is close to atomically abrupt. A simplex optimization algorithm was implemented in Pascal so that it is now possible to extract detailed profile information non-destructively from angle-resolved XPS data. Theoretical calculations showed the excellent sensitivity of this technique to composition profile changes. DOE

N86-28772# Los Alamos National Lab., N. Mex.
SPACE-TIME COMPLEXITY IN SOLID STATE MODELS
A. R. Bishop 1985 12 p Presented at the 9th Gwatt Meeting of the Swiss National Science Foundation, Gwatt, Switzerland, 17 Oct. 1985
(Contract W-7405-eng-36)
(DE86-006032; LA-UR-86-269; CONF-8510267-1) Avail: NTIS HC A02/MF A01

In this workshop on symmetry breaking it is appropriate to include the evolving fields of nonlinear-nonequilibrium systems in which transitions to and between various degrees of complexity (including chaos) occur in time or space or both. These notions naturally bring together phenomena of pattern formation and chaos and therefore have ramifications for a huge array of natural sciences: astrophysics, plasmas and lasers, hydrodynamics, field theory, materials, and solid state theory, optics and electronics, biology, pattern recognition and evolution, etc. The particular concern here are with examples from solid state and condensed matter. DOE

N86-28773# United Kingdom Atomic Energy Authority, Harwell (England). Instrumentation and Applied Physics Div.
EFFECTS OF SPACE RADIATION ON ADVANCED SEMICONDUCTOR DEVICES. PART 4: A STUDY OF THE LET OF FISSION PARTICLES EMITTED BY Cf252 Final Report
T. K. Sanderson, D. Mapper, J. H. Stephen, and J. Farren Jul. 1985 45 p
(Contract ESTEC-4963/81-NL-MS)
(AERE-R-11709-Pt-4; ESA-CR(P)-2165; ESA-86-96865) Avail: NTIS HC A03/MF A01

It is demonstrated that Cf 252 fission particles have a high linear energy transfer (LET) in aluminum. Investigations of the behavior of the LET with decreasing energy show that the Northcliffe and Schilling (1970) data is the most suitable for predicting the behavior of fission particles in light, solid absorber. It is confirmed that the mean masses, energies, and atomic numbers adopted for the representative ions of the two fission fragment groups can be used to predict their overall behavior. It is shown that the mean LET of Cf 252 fission particles can be reduced to 20 MeV/mg sq cm and so possibly provide a wider application of the Cf 252 source for single event testing. However, a further reduction of the LET is presents practical problems. The limited range of the ions and the presence of passivation and dead layers would restrict the use of absorbers in single event upset testing with fission particles. ESA

N86-28774# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
ABSOLUTE PHOTOYIELD MEASUREMENTS ON METAL-SEMICONDUCTOR DETECTORS
Birgitta Larsson Jan. 1986 31 p In SWEDISH; ENGLISH summary
(FOA-C-30412-E1,E3; ISSN-0347-3708; ESA-86-97039) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, KR 50

Measurements were performed on semiconductor structures with palladium, palladium silicide, platinum, and gold as metal layers on p-type silicon. The best photoyield is measured for 500 A palladium on p-type silicon: 0.09% at a wavelength of 2 micrometers. The platinum detector does not show such a linear relation as the Pd detector: different barrier heights are noted. The gold detector shows an impedance which was practically a capacitance. ESA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-28775*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UNIVERSALITY IN THE COMPRESSIVE BEHAVIOR OF SOLIDS
Pascal Vinet, John Ferrante, John R. Smith (General Motors Research Labs., Warren, Mich.), and James H. Rose (Iowa State Univ. of Science and Technology, Ames.) Apr. 1986 11 p
(NASA-TM-87303; E-2702-1; NAS 1.15:87303) Avail: NTIS HC A02/MF A01 CSCL 08M

It was discovered that the isothermal equation of state for solids in compression is a simple, universal form. This single form accurately describes the pressure and bulk modulus as a function of volume for tonic, metallic, covalent, and rare gas solids. Author

N86-28776*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE EFFECTS ON THE UNIVERSAL EQUATION OF STATE OF SOLIDS
Pascal Vinet, John Ferrante, John R. Smith (General Motors Research Labs., Warren, Mich.), and James H. Rose (Iowa State Univ. of Science and Technology, Ames.) Apr. 1986 29 p
(NASA-TM-87321; E-3001; NAS 1.15:87321) Avail: NTIS HC A03/MF A01 CSCL 08M

Recently it has been argued based on theoretical calculations and experimental data that there is a universal form for the equation of state of solids. This observation was restricted to the range of temperatures and pressures such that there are no phase transitions. The use of this universal relation to estimate pressure-volume relations (i.e., isotherms) required three input parameters at each fixed temperature. It is shown that for many solids the input data needed to predict high temperature thermodynamical properties can be dramatically reduced. In particular, only four numbers are needed: (1) the zero pressure (P=0) isothermal bulk

modulus; (2)it P=0 pressure derivative; (3) the P=0 volume; and (4) the P=0 thermal expansion; all evaluated at a single (reference) temperature. Explicit predictions are made for the high temperature isotherms, the thermal expansion as a function of temperature, and the temperature variation of the isothermal bulk modulus and its pressure derivative. These predictions are tested using experimental data for three representative solids: gold, sodium chloride, and xenon. Good agreement between theory and experiment is found. Author

N86-28777# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics and Astronomy.
RESEARCH IN THEORETICAL PHYSICS Annual Progress Report, 1 Apr. 1985 - 31 Mar. 1986
G. Domokos and S. Koevesi-Domokos Nov. 1985 12 p
(Contract DE-FG02-85ER-40211)
(DE86-005504; DOE/ER-40211/1) Avail: NTIS HC A02/MF A01

Research on dynamical symmetry breaking shows a definite pattern of breakdown: a strong version of Michel's conjecture is valid. Signatures of high energy structures can be searched for in e^+e^- annihilation: formulae are given in order to analyze experiments for existence of heavy vector mesons or anomalous interactions. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N86-28778# National Academy of Sciences - National Research Council, Washington, D. C.
MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION: A RESEARCH AGENDA Final Report
1985 100 p Sponsored by National Inst. of Education
(Contract NIE-400-83-0059)
(PB86-160942) Avail: NTIS HC A05/MF A01 CSCL 05A

An agenda for research in mathematics, science, and technology education that will contribute to understanding the causes of and ameliorating current deficiencies in these areas is presented. Recommendations are made in four broad categories: research on the development of reasoning skills; research that facilitates increasing the amount of quality learning time through better instruction; research that facilitates increasing quality learning time through better settings for learning; and research that facilitates increasing quality learning time through the development of new learning systems. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N86-28779# Defense Technical Information Center, Alexandria, Va.
HOW EBENEZER SCROOGE AND PETER DRUCKER ARE HELPING SHAPE DOD'S SCIENTIFIC AND TECHNICAL INFORMATION PROGRAM
Richard D. Douglas 1985 5 p
(AD-A165640) Avail: NTIS HC A02/MF A01 CSCL 05/1

This paper is about developing a long range plan for the Defense Technical Information Center (DTIC). That plan, DTIC 2000 - A Corporate Plan for the Future, was published in July 1984. This paper highlights the methodology used to develop the plan. It also outlines an anticipated future information environment in which the Center will operate. Additionally, it displays the long range Scientific and Technical Information Program (STIP) goals which were developed for DTIC in the planning process. Before developing the plan, the group researched many planning and management reference sources. Two of these were particularly helpful in determining the planning methodology used to develop DTIC 2000. One key reference was written by Peter Drucker (Management: Tasks, Responsibilites, Practices), a recognized authority in the field of planning and management. The other key reference was from an unexpected source and author A Christmas Carol by Charles Dickens. Drucker's advice to long range planners closely parallels insights presented by Dickens in his Christmas story. GRA

N86-28780# Applied Science Associates, Inc., Valencia, Pa.
COST AND INFORMATION EFFECTIVENESS ANALYSIS. VOLUME 1: IMPROVED METHODOLOGY Final Report, Feb. 1981 - Jun. 1982
John K. Hawley, Bryan E. Brett, and William A. Chapman Jan. 1986 209 p
(Contracts MDA903-80-C-0212; DA Proj. 2Q2-63743-A-794)
(AD-A165844; ARI-RN-86-04) Avail: NTIS HC A10/MF A01 CSCL 14/1

Presented are the results of an effort to develop an improved methodology for the conduct of Cost and Information Effectiveness Analysis (CIEA). CIEA is a methodology for the evaluation of training device performance assessment capabilities (D-PACs). It is directed at the problem of determining when the worth of performance status information available from a D-PAC offsets the costs required to develop, operate, and maintain the capability. Such a determination may be needed in order to specify requirements for a D-PAC, or as a basis for deciding between two or more D-PAC design options intended to satisfy prespecified requirements. Following the introductory section, a review of objective procedures for the assessment of information worth is presented. An objective method for information worth evaluation based upon the use of Combat Simulation Models (CSMs) is then explored in detail. The results of this evaluation indicated that a CSM-based CIEA procedure, while technically feasible, is not practical. The report presents results from a series of formative tryouts of alternative multiattribute utility measurement (MAUM) procedures for the conduct of CIEA. Based upon these empirical results, recommendations for an improved MAUM-based CIEA methodology are made. GRA

N86-28781# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. des Systemes Balistiques et Spatiaux.
BASIC RULES TO DEVELOP AND IMPLEMENT COMPLEX SYSTEMS [REGLES ESSENTIELLES DE LA CONDUITE DU DEVELOPPEMENT ET DE LA REALISATION DE SYSTEMES COMPLEXES]
P. Merian 1986 10 p In FRENCH Presented at ESTORIL, Portugal, 17-21 Jun. 1985
(SNIAS-861-422-102; ESA-86-97159) Avail: NTIS HC A02/MF A01

Rules concerning the overall management of large ballistic or space projects characterized by the participation of many industrial partners or subcontractors are discussed. Product requirements; technical specifications; the design phase; material and software constituents; quality, reliability, safety, and maintenance; and cost requirements are considered. ESA

N86-28782# National Bureau of Standards, Gaithersburg, Md. Center for Chemical Physics.
TECHNICAL ACTIVITIES 1985, CENTER FOR CHEMICAL PHYSICS
P. Ausloos Dec. 1985 357 p
(PB86-147336; NBSIR-85/3257) Avail: NTIS HC A16/MF A01 CSCL 07D

Research projects, measurement method development, testing and data evaluation activities carried out during FY-85 in the National Bureau of Standards Center for Chemical Physics are summarized. These activities fall in the areas of surface science, chemical kinetics, chemical thermodynamics, and molecular spectroscopy. GRA

N86-28783# Mohawk Research Corp., Lake Forest, Ill.
FINANCING APPLIED R AND D IN SMALLER COMPANIES
M. L. Rorke, H. C. Livesay, H. Kierulff, and A. Ramseur Oct.

1985 14 p
(PB86-196987) Avail: NTIS HC $11.50/MF A01 CSCL 05A

The authors have been interested in the issues surrounding financing for small firms since 1977. This series of research projects conducted in the U.S. and abroad included a series of workshops held in the period 1982 to 84. These workshops involved a broad spectrum of financiers ranging from passive investors of small amounts of money to professional venture capital firms investing millions of dollars in syndication with other venture capital firms. GRA

N86-28784# National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
PROJECT SUMMARIES, FY 1985
Sep. 1985 80 p
(PB86-183589; NSF-85-324) Avail: NTIS HC A05/MF A01 CSCL 05A

Included are summaries of over 75 projects that were in work during FY 1985 in the National Science Foundation's Division of Science Resources Studies. These projects concern the collection, interpretation, and analysis of data on characteristics, education, and employment of human resources (scientists, engineers, and techicians); on government, industry, and university funding of science and technology; on outputs and impacts of science and technology resources; and on international science and technology. Summaries include information on objectives, findings, methodology, authorship, and availability of resulting publications. The Project Summaries report is published annually. GRA

N86-28785# Farrell Lines, Inc., N.Y.
MICROCOMPUTER-BASED COST ANALYSIS SYSTEM. VOLUME 2: TRAINING TUTORIAL Report, Oct. 1982 - Jan. 1985
L. Smith and N. F. Kondas Nov. 1985 64 p Sponsored by Maritime Administration Prepared in cooperation with Temple, Barker and Sloane, Inc., Lexington, Mass.
(PB86-181948; MA-RD-770-85041-Vol-2) Avail: NTIS HC A04/MF A01; also available in set of 3 reports HC E99 as PB86-181922 CSCL 05A

A project to develop an overall corporate cost accounting and planning system having four main objectives is discussed. The objectives are: to create productivity standards and cost accountability at the local level by implementing an automated weekly cost reporting system; to capture detailed intermodal transportation cost and summarize cost and recovery to help tariff making and cost control; to use the automated cost reporting system data base to improve accuracy and timeliness of preparation of corporate financial statements; and to create matrices of intermodal through unit costs for flexible freight solicitation decision making. GRA

N86-28786# Farrell Lines, Inc., N.Y.
MICROCOMPUTER-BASED COST ANALYSIS SYSTEM. VOLUME 3: USERS GUIDE Report, Oct. 1982 - Jan. 1985
L. Smith and N. F. Kondas Nov. 1985 107 p Sponsored by Maritime Administration Prepared in cooperation with Temple, Barker and Sloane, Inc., Lexington, Mass.
(PB86-181955; MA-RD-770-85042-Vol-3) Avail: NTIS HC A06/MF A01; also available in set of 3 reports HC E99 as PB86-181922 CSCL 05A

A project to develop an overall corporate cost accounting and planning system is discussed. It has four main objectives: to create productivity standards and cost accountability at the local level by implementing and automated weekly cost reporting system; and to capture detailed intermodal transportation cost and summarize cost and recovery to help tariff making and cost control; to use the automated cost reporting system data base to improve accuracy and timeliness of preparation of corporate financial statement; and to create matrices of intermodal through unit costs for flexible freight solicitation decision making. A user's guide is provided. GRA

N86-28787# National Technical Information Service, Springfield, Va. Office of International Affairs.
TECHNICAL INFORMATION APPROPRIATE FOR DEVELOPING COUNTRIES: SELECTED ABSTRACTS FROM THE NTIS (NATIONAL TECHNICAL INFORMATION SERVICE) DATABASE, 1982-1984 SUPPLEMENT, JANUARY 1986
S. D. Tenney and E. Carroll Jan. 1986 341 p Sponsored by Agency for International Development
(PB86-122058) Avail: NTIS HC A04/MF A01 CSCL 05A

Documentation was created to support the transfer of technology to developing countries. NTIS performed a search of its database for reports placed into the system between 1982 to 1984 which were determined to be useful in the developing world. The 1986 edition lists over 2500 citations with abstracts and should be read in conjunction with the 1983 edition of the Bibliography of Appropriate Technology Information for Developing Countries (PB83-113852). Citations were selected for their applicability to local development problems in the Third World. The technology chosen can be adapted and applied to help solve development problems and foster self-reliance among low income groups. Categories cover low and intermediate technologies, labor-intensive technologies, social and management technologies and selected modern technologies. A number of management planning reports are included to assist planning in the countries involved. It was developed for use by business and industry, extension centers, research and educational institutions and consultants and policy planners. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-28788* National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS
Jul. 1986 52 p
(NASA-SP-7039(29)-Sect-1; NAS 1.21:7039(29)-Sect-1) Avail: NTIS HC A04 CSCL 05B

Abstracts are provided for 115 patents and patent applications entered into the NASA scientific and technical information system during the period January 1986 through June 1986. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent application. Author

N86-28789* National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES (SUPPLEMENT 29)
Jul. 1986 483 p
(NASA-SP-7039(29)-Sect-2; NAS 1.21:7039(29)-Sect-2) Avail: NTIS HC A21 CSCL 05B

Entries for over 4400 patents and patent applications citations for the period May 1969 through June 1986 are listed. Subject, invention, source, number, and accession number indexes are included. B.G.

N86-28790# Fondazione Ugo Bordoni, Rome (Italy).
A FIRST APPROACH TO THE IMPLEMENTATION OF DATA BASE INTERROGATION BY NATURAL LANGUAGE [UN PRIMO APPROCCIO ALLA REALIZZAZIONE DI UN SISTEMA PER LINTERROGAZIONE DI UNA BASE DI DATI MEDIANTE LINGUAGGIO NATURALE]
Andrea DiCarlo Aug. 1985 44 p In ITALIAN
(FUB-16-1985; ESA-86-97083) Avail: NTIS HC A03/MF A01

A telephone directory automatic voice answering system is studied using flexible parsing techniques. The syntax and semantics of language phrases in which words do not follow a fixed order are analyzed. A semantic grammar is developed and a nondetermi-

nistic processor is used for the recognition of the interrogation. The principles of an answer generator based on a template grammar are described. The resulting system has applications in the study of problems in man-machine interactions. ESA

N86-28791# Societe Nationale Industrielle Aerospatiale, Paris (France).
TECHNICAL DOCUMENTS [LA DOCUMENTATION TECHNIQUE]
V. Ploix 1986 17 p In FRENCH
(SNIAS-861-320-103; ESA-86-97157) Avail: NTIS HC A02/MF A01

The technical documents that go along with a product are discussed in order to emphasize their importance in personnel development and training. ESA

N86-28792# Institute of Gas Technology, Chicago, Ill.
ON-LINE INTERACTIVE DATABASE FOR THE STORAGE AND RAPID INFORMATION RETRIEVAL OF GAS INDUSTRY DATA
Judson J. Kruse, Carl D. Landahl, and Donald L. Klass 1985 12 p Presented at the Personal Computer Applications in the Gas Industry Conference, Rosemont, Ill., 15-17 Jul. 1985
(TI86-900895; CONF-8507111-1) Avail: NTIS HC A02/MF A01

GasLine is an on-line interactive database for the storage and rapid information retrieval of archival-type gas industry data. It is the first database of its kind dedicated to serving the gas industry with archival information. Several years of Gas Abstracts are already on-line and Energy Statistics will be available shortly. One of the features of gasLine is the availability of both textual and numerical data. Overall, a broad scope of information, much of which is not given wide distribution, will be made readily available on gasLine. GasLine will be available via TYMNET telecommunications. Benefits to the gas industry are far-ranging and can have a major impact in the areas of marketing, operations, finance, research, engineering, legal, regulatory, and policy functions. GasLine will be available for direct access by information specialists as well as other end users. Usage of gasLine is expected to result in higher individual productivity and greater efficiency of information and data manipulation and analysis. The best benefits are the combination of retrieval of need information almost instantaneously, and its strategic application. This is the essence of the time value of information which is likened to the time value of money or capital. Author

N86-28793# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Technical Information Panel.
THE VALUE OF INFORMATION AS AN INTEGRAL PART OF AEROSPACE AND DEFENCE R AND D PROGRAMMES
Loughton, England Jan. 1986 96 p Meeting held in Cheltenham, England, 4-5 Sep. 1985
(AGARD-CP-385; ISBN-92-835-0389-9) Avail: NTIS HC A05/MF A01

The management and use of scientific and technical information in the R and D process is examined from the perspective of policy makers, program managers, and researchers. Aspects considered at the meeting included the need to incorporate information as an integral part of the R and D process, the value of information in reducing the cost and preventing the duplication of research, improvements in the sharing of information resources among the NATO countries, and requirements for the future. For individual titles, see N86-28794 through N86-28803.

N86-28794# British Aerospace Public Ltd. Co., Weybridge (England). Divisional Technical Directorate.
THE POLICY MAKER LOOKS AT INFORMATION
J. B. Scott-Wilson and J. P. Hasinski *In its* The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 9 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

The policy making heirarchy within British Aerospace is described and the information routes to and from an intermediate level policy maker (Divisional Technical Director) are examined. The information paths for two typical research projects are considered as examples: the use of aluminum/lithium alloys as structural materials and the initiation and development of a new aircraft project. Information quality and the use of automated techniques by policy makers are also discussed. M.G.

N86-28795# NATO Integrated Communications System Management Agency, Brussels (Belgium).
A PROGRAMME MANAGER'S NEEDS FOR INFORMATION
I. Mason-Smith *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 8 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

The underlying basis for the information need of the program manager within the NATO Integrated Communications System Agency (NICSMA) is examined in some detail, in terms of the role of that agency as exemplified by its current charter. The various specific needs of the program planner working within this framework are then identified and critically reviewed. Finally, the paper notes the expanding role of the remodelled agency (NACISA) to include the development of both communications and information systems for NATO; in this context, the urgent need to re-examine the basic information requirements of the Agency is encouraged and proposals sought. Author

N86-28796# Raitt (D. I.), Den Haag (Netherlands).
THE INFORMATION NEEDS OF SCIENTISTS AND ENGINEERS IN AEROSPACE
D. I. Raitt *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 5 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

A brief description of a recent research project to ascertain the communication and information-seeking and use habits of scientists and engineers working in aerospace research establishments and other organizations is given. Relevant organizations studied include DFVLR, NLR, CNES and ESA. Following an overview of the basic characteristics of scientists and engineers, a review of the project's major findings as they relate to the type of information required by scientists and engineers, its availability, the sources - both oral and written - from which the information is obtained and the scientists and engineers awareness of them, how they keep up-to-date, the time spent seeking information, the use made of the library and the communication patterns of scientists and engineers, is then given. Some general suggestions for improving the communication and information flow within organizations to the satisfaction of practicing scientists and engineers are made. Author

N86-28797# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C. Research and Laboratory Management.
INFORMATION SERVICES: PROS AND CONS
Leo Young *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 8 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

A strong science and technology base is a national necessity in a competitive world, and adequate communication is a prerequisite for it. An individual, be it a policy maker, program manager, a bench scientist or engineer resorts to the information system if he believes it will save him or her time to first consult the written record rather than to undertake a repetitious experiment or investigation. The three components to an effective information service are the sources (those who provide or produce information), the users (those who need the information) and the professional information specialists (those who bind the whole system together). The cooperation toward information exchange of all those connected with research and development must be enlisted in support of the system of which they are a part. Author

N86-28798# Engineering Sciences Data Unit, London (England).
THE COSTS OF NOT HAVING REFINED INFORMATION

Anthony J. Barrett *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 9 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

The adequacy of the information resources, which are called upon for support at decision points in the research-design-production-marketing process, can in part be measured by their scope, the presence or absence of information within that scope and, increasingly, by the extent to which they offer refinement in terms of the timeliness and quality of the information which can be retrieved. Timeliness in the present context relates not so much to the response time of the information system as to the extent to which that system is tuned to the volatility of the information which it contains. Likewise, the quality of information is not to be judged only by its relevance and authenticity but also by the convenience of its form of presentation in the view of the decision maker who has need of it. The main focal points of the paper are the costs, disruption and other losses which arise from a lack of knowledge of previous work, the use of out-of-date technical information and, in particular, the extent to which the use of insufficiently refined numerical data leads to the under-, or over-, design of hardware. These are illustrated by a number of quantified examples. The transition from an industrially based to an information or service based society highlights the growing needs of the R&D decision maker and others for systems which will provide high quality numerical and factual data. However, substantiation of these needs may never be available in terms of evidence of direct future benefits as distinct from evidence of historic losses. More dynamic means of demonstrating the impact of information quality upon the interests of the decision maker must be devised and guidelines for two such projects are suggested. Author

N86-28799# King Research, Inc., Rockville, Md.
MEASURING THE VALUE OF INFORMATION AND INFORMATION SYSTEMS, SERVICES AND PRODUCTS
Donald W. King and Jose-Marie Griffiths *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 15 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

An approach for measuring the value of information and information systems, services and products is presented. Results of four research projects that have measured value of recorded information used by professional such as scientists, engineers, managers, etc. are also discussed. Furthermore, data are given on the value of such systems and services as a bibliographic database of international publications, online search systems and libraries. The approach used to measure value includes several perspectives. The first perspective is what users are willing to pay for information in terms of money (if exchanged) and the price paid by users in terms of their time and effort to get and read the information. Once information is read and assimilated, there are many purposes for which it might be used such as in one's work, to educate oneself or others, to satisfy one's curiosity, etc. The consequential value resulting from information use is partially measured by the savings that are derived from information use. Higher order values are how the consequential value affects the user's organization and, in turn, society. Author

N86-28800# National Defence Headquarters, Ottawa (Ontario). Directorate of Industry and Univ. Programs.
INTERNATIONAL INFORMATION EXCHANGE PROGRAMMES ARE NECESSARY
A. S. Reeves *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 5 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

The economic and cultural ties between Canada, the U.S. and European nations are enhanced by various means of information exchange between and among countries. The benefits of two different but interconnected processes of technology transfer are discussed: the alerting of allies to information available and the exchange of document literature. Since concern about national security and proprietary information may preclude defence research and development programs from publishing; as do other disciplines, in the open literature, special exchange agreements are necessary. The programs which have existed for some years among various NATO countries usually limit the subject areas of common interest to be discussed, and the organizations to be included. This process is illustrated using the Canadian situation. Some of the existing Canadian exchange agreements are examined, showing how they operate, the types of information which are included, the routes by which information is passed from one country to another. The ways in which information passes through the documentation centers to become a valuable service to the end users and thus enhance research and development productivity are detailed. Specific examples of the use of international information exchange programs to some major defence projects are shown. The release of information is beneficial to the releasing country as well as to the receiving country because of the increased visibility of the information and the resulting reciprocal transfer of related data.
M.G.

N86-28801# Royal Library of Belgium, Brussels.
THE IDEAL INFORMATION SYSTEM? WHAT DOES THE USER REALLY WANT?
Guy M. Vanautryve *In* AGARD The Value of Information as as Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 4 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

In planning future information systems, it is of utmost importance to take into account the user who finally decides on the success of the systems. So far, system improvements have mainly been implemented with the experienced user in mind. Therefore, if the information systems want to get a better penetration, they will have to implement interfaces faciliting the accessibility of the information by the non-experienced user. Also, access to those idealized information systems could be improved through better cooperation between telecommunication authorities. Author

N86-28802# BULL, Louveciennes (France).
NEW TECHNOLOGIES FOR IMPROVED INFORMATION SYSTEMS AND SERVICES
Gilles Gauthier-Villars *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 12 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

Information data bases are growing exponentially both because of the number of records and because of the type of data. The number of occurrences encompassed by a data base has an evident influence on its volume, but as one moves from coded data to textual data and to images the need for space grows as well. Data is dear to the user. It is expensive to capture and it is important that it reaches all applications which needs it. So to keep the whole problem of data management under control storage, processing and transfer techniques evolve rapidly. This paper is focused on three important technological breakthroughs in each of these domains: a new storage technique, the optical disc; a new way to process data, the expert systems; and a new way to exchange data, with query languages. Author

N86-28803# Fachinformationszentrum fuer Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen (West Germany). Energy and Technology Div.
INFORMATION RESOURCES MANAGEMENT IN THE R AND D ENVIRONMENT
K. Buerk *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes Jan. 1986 4 p (For primary document see N86-28793 19-82)
Avail: NTIS HC A05/MF A01

Efficient management of highly specialized information is a permanent task of optimization, whereby framework conditions may constantly change on account of various influencing factors. Owing to their special significance, the following has to be

considered in particular: user needs, available resources, and information techniques. The task of optimization, due to its complexity, cannot be solved model-like, but only approximately and pragmatically. Illustrated by the example of the Federal Republic of Germany and the Fachinformationszentrum Energie Physik Mathematik (FIZ) the attempt to find a practical solution is demonstrated. In this context it is shown which role a National Information Center plays within international and national cooperation including worksharing, and how information supply and dissemination of information works in the case of central information services by FIZ, and decentral dissemination of information in research centers. Illustrated by the examples of database production, online services of bibliographic, numeric and full-text databases and the concept of the International Information Network for Science and Technology (STN International), the importance of the use of the most modern information techiques is demonstrated. Author

N86-28697# Joint Publications Research Service, Arlington, Va.
INFORMATION SYSTEMS FOR LIBRARY DATABASES ORGANIZED
Toomas Etverk *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-004) 25 Apr. 1986 p 27-30 Transl. into ENGLISH from Rahva Haal (Tallinn, Estonia), 31 Jul. 1985 p 2 (For primary document see N86-28694 19-70)
Avail: NTIS HC A04/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N86-28804# Army Engineer Div., Huntsville, Ala.
PAX ECONPACK ECONOMIC ANALYSIS PACKAGE Final Report
Hugh W. Mason Jan. 1986 7 p
(AD-A165660; HNDSP-86-116-ED-ES) Avail: NTIS HC A02/MF A01 CSCL 14/1

The Economic analysis Package (ECONPACK) Program is an interactive computer system which assists the Department of Defense in the preparation of life cycle costs analysis reports, in support of funding requests for construction programs as well as many other types of programs in accordance with AR 11-28 Economic Analysis and Program Evaluation for Resource Management. GRA

N86-28805# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
A PROFILE OF SELECTED FIRMS AWARDED SMALL BUSINESS INNOVATION RESEARCH FUNDS
Mar. 1986 15 p
(AD-A165664; GAO/RCED-86-113FS) Avail: NTIS HC A02/MF A01 CSCL 05/3

The General Accounting Office conducted interviews and developed a profile of the 19 firms, obtained a description of their research work and experiences with the SBIR (Small Business Innovative Research) program, and identified efforts these firms were making to commercialize products or services developed with SBIR funding. The information collected was from firms receiving awards in fiscal years 1983 and 1984. To obtain additional information about commercialization of products developed with SBIR funding, we interviewed officials at eight venture capital firms and three experts on small business innovation. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N86-28806# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
UNIVERSITY FUNDING. ASSESSING FEDERAL FUNDING MECHANISMS FOR UNIVERSITY RESEARCH
Feb. 1986 37 p
(AD-A165721; GAO/RCED-86-75) Avail: NTIS HC A03/MF A01 CSCL 05/1

Over 60 percent of university research funding comes from federal agencies. this research is a key element in the United States' international competitiveness and technology advancement. Others sources for research funding include industry, foundations, and state governments. Approximately 71 percent of the federal research funds are provided through one funding mechanism or category of federal financial support for scientific research -- individual project grants. Some scientists and policymakers have questioned the consequences of such heavy reliance on individual project grants. For example, does this mechanism discourage the performance of innovative, high-risk, and interdisciplinary research? In response to the House Committee on Science and Technology's request that GAO assess the effects of; different funding mechanisms on the productivity and performance of research, GAO looked at: Whether particular funding mechanisms played a role in helping universities improve program quality. Whether two funding mechanisms -- individual project grants and center grants -- had different effects on the performance of research. GAO looked at five universities that, according to surveys of the scientific community carried out by two education and research organizations, had reputed improvement in program quality. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-28807# Office of Naval Research Liason Office, Far East, APO, San Francisco, Calif.
ONR FAR EAST SCIENTIFIC BULLETIN. VOLUME 10, NUMBER 3, JULY-SEPTEMBER 1985
George B. Wright and Mary Lou Moore Sep. 1985 137 p
(AD-A165601) Avail: NTIS HC A07/MF A01 CSCL 09/1

Recent developments in Far Eastern (particularly Japanese) scientific research are discussed. Computers, computer techniques, integrated circuits, gallium arsenides, and telecommunication technology are among the topics covered. GRA

N86-28808# Catholic Univ. of America, Washington, D.C.
REGIONAL DEVELOPMENT IMPACTS AND THEIR MEASUREMENTS
Ung S. Kim Nov. 1985 66 p
(Contract DACW72-83-C-0010)
(AD-A165687; IWR-CR-85-C-6) Avail: NTIS HC A04/MF A01 CSCL 05/3

This report reviews several analytical models which can be used for estimating the regional economic development impacts of water resource projects. A review of the history of Corps of Engineers efforts to introduce a working concept of economic development in various regions of the United States is also included. The final section of the report presents the theory, techniques and data sources for three analytical models and evaluates each model. GRA

N86-28809# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
MATERIALS RESEARCH: THE PROGRAM OF THE FEDERAL

MINISTRY FOR RESEARCH AND TECHNOLOGY [MATERIAL-FORSCHUNG: PROGRAMM DES BUNDEMINISTERS FUER FORSCHUNG UND TECHNOLOGIE]
1985 63 p In GERMAN
(ESA-86-96939) Avail: NTIS HC A04/MF A01

The program of the German Federal Ministry of Research and Technology in the field of materials research is presented. The significance of materials for technical and economic efficiency is discussed. The international status of materials science is depicted. The political concept for materials research is explained. The emphasis of the program is on structural materials (construction materials) of inorganic nature (metals, non-metals, ceramics, glasses), and on structural and functional materials of organic-chemical nature (polymers). ESA

N86-28810# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Spatiaux.
LEGAL FRAMEWORK AND NATIONAL INDUSTRIAL DEVELOPMENT:BAD CAPS LANGUAGE[ny] THE IMPACT ON TECHNOLOGY TRANSFERS [CADRE JURIDIQUE ET DEGRE DE DEVELOPPEMENT INDUSTRIEL: IMPACTS SUR LES TRANSFERTS DE TECHNOLOGIE]
M. F. Murphy 1986 6 p In FRENCH Presented at AFCET Salon Intern. des Tech.. et Energies du Futur, Toulouse, France, 24-25 Oct. 1985
(SNIAS-861-422-104; ESA-86-97161) Avail: NTIS HC A02/MF A01

Technology transfer given the limitations imposed by French regulations is discussed. The problems related to customs, currency control, insurance, and producer warranties are examined. The complexity of the regulations is pointed out. It is shown that considerable efforts are required to overcome these obstacles.The particular problems of the aerospace industry are mentioned. ESA

88 SPACE SCIENCES (GENERAL)

N86-28811*# Lunar and Planetary Inst., Houston, Tex.
INTERNATIONAL WORKSHOP ON ANTARCTIC METEORITES
J. O. Annexstad, L. Schultz, and H. Waenke 1986 122 p Workshop held in Mainz, West Germany, 10-12 Jul. 1985; sponsored by the International Association of Geometry and Cosmochemistry, LPI and the Max-Planck-Society
(Contract NASw-4066)
(NASA-CR-177309; NAS 1.26:177309; LPI-TR-86-01) Avail: NTIS HC A06/MF A01 CSCL 03B

Topics addressed include: meteorite concentration mechanisms; meteorites and the Antarctic ice sheet; iron meteorites; iodine overabundance in meteorites; entrainment, transport, and concentration of meteorites in polar ice sheets; weathering of stony meteorites; cosmic ray records; radiocarbon dating; element distribution and noble gas isotopic abundances in lunar meteorites; thermoanalytical characterization; trace elements; thermoluminescence; parent sources; and meteorite ablation and fusion spherules in Antarctic ice. For individual titles, see N86-28812 through N86-28833.

N86-28812*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METEORITE CONCENTRATION MECHANISMS IN ANTARCTICA **c90**
John O. Annexstad *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 23-25 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

The location of most Antarctic meteorite finds is on stagnant, highly ablative surfaces known as blue ice. The role of blue ice as transporter, concentrator, and preserver of specimens from the time of fall until find is discussed. B.G.

N86-28813*# Pittsburgh Univ., Pa. Dept. of Geology and Planetary Science.
METEORITES AND THE ANTARCTIC ICE SHEET **c90**
W. A. Cassidy *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 26-27 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

The majority of the meteorite finds were located in the Allan Hills site. All the expected goals involving the recovery of rare or previously unknown types of meteorites, and even the recovery of lunar ejecta, were realized. The relationship between these remarkable concentrations of meteorites and the Antarctic ice sheet itself were less well documented. Ice flow vector studies were made and concentration models were proposed. Earlier estimates of the abundances of meteorite types were based on the number of falls in the world collections. The accumulated data and the future collected data will allow more reliable estimates of the source region of most meteorites. B.G.

N86-28814*# Smithsonian Institution, Washington, D. C. Div. of Meteorites.
ANTARCTIC IRON METEORITES: AN UNEXPECTEDLY HIGH PROPORTION OF FALLS OF UNUSUAL INTEREST **c90**
Roy S. Clarke, Jr. *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 28-29 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

The inhabited and explored areas of Earth have contributed 725 iron meteorites, accounting for 28% of the 2611 authenticated meteorites known of all types. Observed fall statistics give a much different view of relative abundance. The 42 historic iron meteorite falls spanning 230 years suggests a frequency of one fall per 5.6 years and represents only 4.9% of the total 853 known falls. Antarctic iron meteorite recoveries offer promise of providing a new perspective on the influx problem. At least 42 iron meteorite specimens were found during the last 25 years by various field teams working in Antarctica. Most of these specimens were not described in detail, but the available data indicates that 21 separate falls are represented, 50% of the number of recovered specimens. Twelve of the 21 falls were both structurally classified and placed into chemical groups. They are listed in order of increasing structural complexity and/or Ni content. B.G.

N86-28815*# Federal Inst. for Geosciences and Natural Resources, Hannover (West Germany).
DISCOVERY OF METEORITES ON A BLUE-ICE FIELD NEAR THE FRONTIER MOUNTAINS, NORTH VICTORIA LAND, ANTARCTICA **c90**
G. Delisle, H.-C. Hoefle, R. Thierbach, and L. Schultz (Max-Planck-Inst. fuer Chemie, Main, West Germany) *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 30-33 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

A high concentration of meteorites were discovered on a blue ice field northeast of the Frontier Mountains. As a result of a systematic search, a total of 42 meteorites were recovered. The current glacial situation has evolved through various stages, which are discussed in relationship to the concentration of meteorites. Ice flow patterns are summarized. The chemical composition and terrestrial ages of the meteorites are discussed. B.G.

N86-28816*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
MYSTERIOUS IODINE-OVERABUNDANCE IN ANTARCTIC METEORITES **c90**
G. Dreibus, H. Waenke, and L. Schultz *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 34-36 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

Halogen as well as other trace element concentrations in meteorite finds can be influenced by alteration processes on the Earth's surface. The discovery of Antarctic meteorites offered the opportunity to study meteorites which were kept in one of the

most sterile environment of the Earth. Halogen determination in Antartic meteorites was compared with non-Antarctic meteorites. No correlation was found between iodine concentration and the weathering index, or terrestrial age. The halogen measurements indicate a contaminating phase rich in iodine and also containing chlorine. Possible sources for this contamination are discussed.
B.G.

N86-28817*# Cambridge Univ. (England). Polar Research Inst.
ENTRAINMENT, TRANSPORT AND CONCENTRATION OF METEORITES IN POLAR ICE SHEETS **c90**
D. J. Drewry *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 37-47 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

Glaciers and ice sheets act as slow-moving conveyancing systems for material added to both their upper and lower surfaces. Because the transit time for most materials is extremely long the ice acts as a major global storage facility. The effects of horizontal and vertical motions on the flow patterns of Antarctic ice sheets are summarized. The determination of the source areas of meteorites and their transport paths is a problem of central importance since it relates not only directly to concentration mechanisms but also to the wider issues in glaciology and meteorites. The ice and snow into which a meteorite falls, and which moves with it to the concentration area, encodes information about the infall area. The principle environmental conditions being former elevation, temperature (also related to elevation), and age of the ice. This encoded information could be used to identify the infall area.
B.G.

N86-28818*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WEATHERING OF STONY METEORITES IN ANTARCTICA **c90**
J. L. Gooding *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 48-54 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

Weathering produces undesirable physical, chemical, and isotopic changes that might disturb the records of cosmochemical evolution that are sought in meteorites. Meteorites are physically disintegrated by crack propagation phenomena, including ice riving and secondary mineral riving, and are probably abraded by wind that is laden with ice crystals or dust particles. Chemical weathering proceeds by oxidation, hydration, carbonation, and solution and produces a variety of secondary minerals and mineraloids. Differential weathering under freezing conditions is discussed, as well as, the mineralogy of weathering products. Furthermore, the use of Antarctic alteration of meteorites could be used as an excellent analog for weathering on Mars or on cometary bodies.
B.G.

N86-28819*# Cologne Univ. (West Germany). Abteilung Nuklearchemie.
COSMIC RAY RECORDS IN ANTARCTIC METEORITES **c93**
S. Vogt, U. Herpers, R. Sarafin, P. Signer (Eidgenoessische Technische Hochschule, Zurich, Switzerland), R. Wieler, M. Suter, and W. Woelfli *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 55-57 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

The cosmogenic radionuclides Be(10), Al(26), and Mn(53) and noble gases were determined in more than 28 meteorites from Antarctica by nuclear analytical techniques and static mass spectrometry, respectively. The summarized results are listed. The concentrations of Al(26) and Mn(53) are normalized to the repective main target elements and given in dpm/kg Si sub eq and dpm/kg Fe. The errors stated include statistical as well as systematical errors. For noble gas concentrations estimated errors are 5% and for isotopic ratios 1.5%. Cosmic ray exposure ages T sub 21 were calculated by the noble gas concentrations and the terrestrial residence time (T) on the basis of the spallogenic nuclide Al(26). The suggested pairing of the LL6 chondrite RKPA 80238 and RKPA 80248 and the eucrites ALHA 76005 and ALHA 79017 is confirmed not only by the noble gas data but also by the concentrations of the spallation produced radionuclides. Futhermore, ALHA 80122, clasified as an H6 chondrite, has a noble gas pattern which suggest that this meteorite belongs to the ALHA 80111 shower.
Author

N86-28820*# Gakushuin Univ., Tokyo (Japan). Dept. of Chemistry.
RADIOCARBON DATINGS OF YAMATO METEORITES **c90**
K. Kigoshi and E. Matsuda *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 58-60 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

The terrestrial ages of five Yamato Meteorites were measured by the content of cosmic-ray-produced carbon-14. Three Yamato Meteorites Y-74013, Y-74097, and Y-74136, which are all diogenites, were found at sites from one to two kilometers apart from each other. Evidence is presented for these three meteorites being a single meteorite. Also presented is a method adopted in the experimental procedure which includes a check for modern carbon contamination in the meteorites.
B.G.

N86-28821*# Bern Univ. (Switzerland). Lab. fuer Radiochemie.
ELEMENT DISTRIBUTION AND NOBLE GAS ISOTOPIC ABUNDANCES IN LUNAR METEORITE ALLAN HILLS A81005 **c90**
U. Kraehenbuehl, O. Eugster, and S. Niedermann *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 61-64 Sponsored in part by Swiss National Science Foundation (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

Antarctic meteorite ALLAN HILLS A81005, an anorthositic breccia, is recognized to be of lunar origin. The noble gases in this meteorite were analyzed and found to be solar-wind implanted gases, whose absolute and relative concentrations are quite similar to those in lunar regolith samples. A sample of this meteorite was obtained for the analysis of the noble gas isotopes, including Kr(81), and for the determination of the elemental abundances. In order to better determine the volume derived from the surface correlated gases, grain size fractions were prepared. The results of the instrumental measurements of the gamma radiation are listed. From the amounts of cosmic ray produced noble gases and respective production rates, the lunar surface residence times were calculated. It was concluded that the lunar surface time is about half a billion years.
B.G.

N86-28822*# Warsaw Univ. (Poland). Dept. of Chemistry.
THERMOANALYTICAL CHARACTERIZATION OF SEVERAL ANTARCTIC METEORITES **c90**
B. Lang, A. Grodzinski, and L. Stoch (Academy of Mining and Metallurgy, Cracow, Poland) *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 65-67 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

Thermodynamic data for several meteorites from Antarctica (5 achondrites, 2 chondrites, and 1 iron) were derived. The thermochemical response to heating in air was examined. The effects of oxidation processes can often be better identified by comparing the differential thermal analysis (DTA)-curves for heating in air with those obtained for heating in an oxidation-suppressed argon atmosphere. The thermoanalytical method can be helpful in determining the degree of weathering of meteoritic material.
B.G.

N86-28823*# Purdue Univ., West Lafayette, Ind. Dept. of Chemistry.
TRACE ELEMENTS IN ANTARCTIC METEORITES: WEATHERING AND GENETIC INFORMATION **c90**
M. E. Lipschutz *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 68-70 (For primary document see N86-28811 19-88)
(Grants NAG9-48; NSF DPP-81-11513; DEFG-0280-ER-10725)
Avail: NTIS HC A06/MF A01 CSCL 03B

Antarctic meteorite discoveries have created great scientific interest due to the large number of specimens recovered (approximately 7000) and because included are representatives of hitherto rare or unknown types. Antarctic meteorites are abundant because they have fallen over long periods and were preserved, transported, and concentrated by the ice sheets. The weathering effects on the Antarctic meteorites are described. Weathering effects of trace element contents of H5 chondrites were studied in detail. The results are examined. The properties of Antarctic finds and non-Antarctic falls are discussed. B.G.

N86-28824*# California Univ., San Diego, La Jolla. Dept. of Chemistry.

TERRESTRIAL AND EXPOSURE HISTORIES OF ANTARCTIC METEORITES c90

K. Nishiizumi *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 71-73 (For primary document see N86-28811 19-88)

Avail: NTIS HC A06/MF A01 CSCL 03B

Records of cosmogenic effects were studied in a large suite of Antarctic meteorites. The cosmogenic nuclide measurements together with cosmic ray track measurements on Antartic meteorites provide information such as exposure age, terrestrial age, size and depth in meteoroid or parent body, influx rate in the past, and pairing. The terrestrail age is the time period between the fall of the meteorite on the Earth and the present. To define terrestrial age, two or more nuclides with different half-lives and possibly noble gases are required. The cosmogenic radionuclides used are C-14, Kr-81, Cl-36, Al-26, Be-10, Mn-53, and K-40. B.G.

N86-28825*# Physical Research Lab., Ahmedabad (India).

WEATHERING EFFECTS AND SOLAR COMPONENTS IN TWO ALLEN HILLS CHONDRITES c91

J. T. Padia and M. N. Rao *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 74-75 (For primary document see N86-28811 19-88)

Avail: NTIS HC A06/MF A01 CSCL 03B

Two Allen Hills chondrites, ALHA 77252 and ALHA 77215 belonging to the L-group were studied by stepwise heating mass spectrometric methods for elemental and isotopic composition of noble gases. The results are discussed. B.G.

N86-28826*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).

RARE AND UNIQUE METEORITES FROM ANTARCTICA c90

H. Palme *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 77-79 (For primary document see N86-28811 19-88)

Avail: NTIS HC A06/MF A01 CSCL 03B

The detection of Antarctic meteorites of Lunar and perhaps Martian origin, belongs to the most important discoveries in planetology during the last years. There is such a wealth of new information on differentiated and undifferentiated planetary bodies deduced from Antarctic meteorites that it is at present not possible to even qualitatively foresee the impact that these meteorites will have on the understanding of the formation and differentiation of large and small planets in the solar system. Martian meteorites, Lunar meteorites, meteorites from the parent body of basaltic achondrites, and chrondritic meteorites are discussed. B.G.

N86-28827*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).

TERRESTRIAL AGES OF ANTARCTIC METEORITES: IMPLICATIONS FOR CONCENTRATION MECHANISMS c90

Ludolf Schultz *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 80-82 (For primary document see N86-28811 19-88)

Avail: NTIS HC A06/MF A01 CSCL 03B

Antarctic meteorites differ from meteorites fallen in other places in their mean terrestrial ages. Boeckl estimated the terrestrial half-life for the disintegration of stone meteorites by weathering under the climatic conditions of the Western United States to be about 3600 years. Antarctic meteorites, however, have terrestrial ages up to 70000 years, indicating larger weathering half-lives. The terrestrial ages of meteorites are determined by their concentration of cosmic-ray-produced radionuclides with suitable half-lives (C-14, Al-26, and Cl-36). These radionuclides have yielded reliable ages for the Antarctic meteorites. The distribution of terrestrial ages of Allan Hills and Yamato meteorites are examined. B.G.

N86-28828*# Arkansas Univ., Fayetteville. Dept. of Chemistry and Biochemistry.

THERMOLUMINESCENCE AND ANTARCTIC METEORITES c90

Derek W. G. Sears and Fouad A. Hasan *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 83-100 (For primary document see N86-28811 19-88)

(Grant NAG9-81)

Avail: NTIS HC A06/MF A01 CSCL 03B

The level of natural thermoluminescence (TL) in meteorites is the result of competition between build-up, due to exposure to cosmic radiation, and thermal decay. Antarctic meteorites tend to have lower natural TL than non-Antarctic meteorites because of their generally larger terrestrial ages. However, since a few observed falls have low TL due to a recent heating event, such as passage within approximately 0.7 astronomical units of the Sun, this could also be the case for some Antarctic meteorites. Dose rate variations due to shielding, heating during atmospheric passage, and anomalous fading also cause natural TL variations, but the effects are either relatively small, occur infrequently, or can be experimentally circumvented. The TL sensitivity of meteorites reflects the abundance and nature of the feldspar. Thus intense shock, which destroys feldspar, causes the TL sensitivity to decrease by 1 to 2 orders of magnitude, while metamorphism, which generates feldspar through the devitrification of glass, causes TL sensitivity to increase by a factor of approximately 10000. The TL-metamorphism relationship is particularly strong for the lowest levels of metamorphism. The order-disorder transformation in feldspar also affect the TL emission characteristics and thus TL provides a means of paleothermometry. Author

N86-28829*# Otago Univ., Dunedin (New Zealand). Dept. of Geology.

A PRELIMINARY REPORT ON A POSSIBLE STROMATOLITE FIND FROM THE ELEPHANT MORAINE, ANTARCTICA: A POTENTIAL DIRECTIONAL INDICATOR FOR ICE MOVEMENT c90

P. P. Sipiera and C. A. Landis *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 101-103 (For primary document see N86-28811 19-88)

Avail: NTIS HC A06/MF A01 CSCL 03B

During the 1983 to 1984 Antarctic Search for Meteorites field season, numerous specimens of a shiny black rock were collected from among the glacial debris at the Elephant Moraine. From a distance these black rocks gave the appearance of meteorites, but upon closer inspection, distinct layering and radial crystal growth patterns became clearly visible. Laboratory investigations showed that these unusual specimens are primarily composed of carbonate minerals. Petrographically, microscopic examination of twelve randomly collected specimens revealed a variety in the habits of the carbonates, but the overall trend tends to be one of radiating acicular crystals that have the appearance of a pseudo-cellular structure reminiscent of stromatolites. It is not possible at this time to specifically identify this possible stromatolite material or its source locality. B.G.

N86-28830*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.

THERMOLUMINESCENCE OF ANTARCTIC METEORITES: A RAPID SCREENING TECHNIQUE FOR TERRESTRIAL AGE ESTIMATION, PAIRING STUDIES AND IDENTIFICATION OF SPECIMENS WITH UNUSUAL PREFALL HISTORIES c90

S. R. Sutton and R. M. Walker *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 104-106 (For primary document see N86-28811 19-88)

Avail: NTIS HC A06/MF A01 CSCL 03B

Thermoluminescence (TL) is a promising technique for rapid screening of the large numbers of Antarctic meteorites, permitting identification of interesting specimens that can then be studied in detail by other, more definite techniques. Specifically, TL permits determination of rough terrestrial age, identification of potential paired groups and location of specimens with unusual pre-fall histories. Meteorites with long terrestrial ages are particularly valuable for studying transport and weathering mechanisms. Pairing studies are possible because TL variations among meteorites are large compared to variations within individual objects, especially for natural TL. Available TL data for several L3 fragments, three of which were paired by other techniques, are presented as an example of the use of TL parameters in pairing studies. Additional TL measurements, specifically a blind test, are recommended to satisfactorily establish the reliability of this pairing property. The TL measurements also identify fragments with unusual pre-fall histories, such an near-Sun orbits. Author

N86-28831*# Tokyo Univ. (Japan). Mineralogical Inst.
PARENT SOURCES OF ANTARCTIC METEORITES AS INFERRED FROM PAIRING OF THE SPECIMENS c90
Hiroshi Takeda *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 107-109 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

Antarctic meteorites may be derived from regions different than those from which comtemporary falls derive. If so, they are useful in reconstruction of their parent bodies or masses. To obtain a better understanding of the parent sources and their relation to asteroids, several Antarctic achondrites and unique chondrites were reinvestigated with electron microprobe and single crystal X-ray diffraction. Synthesis of their parent body was performed for three classes of meteorites on the basis of pairing of the specimens. The results are discussed for HED (Howardites, Eucrites, Diogenites) Parent Bodies, Ureilite Parent Bodies, and LL Chondrite Parent Bodies. B.G.

N86-28832*# Cologne Univ. (West Germany). Dept. of Nuclear Chemistry.
METEORITIC ABLATION AND FUSION SPHERULES IN ANTARCTIC ICE c90
K. Thiel, J. Peters, G. M. Raisbeck (Centre National de la Recherche Scientifique, Orsay, France), and F. Yiou *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 110-112 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

In the course of two Antarctic expeditions in 1980/1981 and 1982/1983 approximately 4 metric tons of documented ice samples were collected from the Atka Bay Ice Shelf, Antarctica, and subsequently shipped for cosmic dust studies. After filtration of the melt water, approximately 700 Antarctic spherules (AAS) in the size range of 5 to 500 microns were handpicked from the filter residue under optical microscopes. For the chemical investigation of single dust grains the following techniques were applied: scanning electron microscopy (SEM), X-ray analysis (EDAX), instrumental neutron activation analysis (INAA), laser microprobe mass analysis (LAMMA), and accelerator mass spectroscopy (AMS). For more than 95% of the total mass the bulk and trace elements were determined in single grain analyses using EDAX, INAA, and LAMMA. The element pattern of the dust particles was compared with that of typical terrestrial material and meteoritic matter. The majority of the spherules exhibited elemental compositions compatible with meteoritic element patterns. B.G.

N86-28833*# National Inst. of Polar Research, Tokyo (Japan).
OVER 5,600 JAPANESE COLLECTION OF ANTARCTIC METEORITES: RECOVERIES, CURATION AND DISTRIBUTION c90
K. Yanai and H. Kojima *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 113-116 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

The history of recovery of meteorite fragments in the Yamato Mountains, Allan Hills, and Victoria Land, Antarctica is reviewed. The Japanese collection of Antarctic meteorites were numbered, weighed, photographed, identified, and classified. Sample distribution of the Japanese Antarctic meteorites is described. B.G.

N86-28834# Osmania Univ., Hyderabad (India). Centre of Advanced Study in Astronomy.
PROCEEDINGS OF THE PLATINUM JUBILEE SYMPOSIUM OF NIZAMIAH OBSERVATORY ON BINARY AND MULTIPLE SYSTEMS
K. D. Abhyankar, ed. and G. M. Ballabh, ed. 1984 163 p Symposium held in Hyderabad, India, 22-24 Nov. 1983; sponsored by Osmania Univ., Univ. Grants Commission, Dept. of Science and Technology, Indian Space Research Organisation and Astronomical Society of India
Avail: NTIS HC A08/MF A01

Topics addressed include: binary eclipsing stars, multiple galaxies, galactic clustering, gravitational lenses and multiple quasars, radio and X-ray emission in radio-loud quasars, minor planets and planetary rings, comets, and interstellar medium. For individual titles, see N86-28835 through N86-28848.

N86-28835# Osmania Univ., Hyderabad (India). Centre of Advanced Study in Astronomy.
MULTIPLICITY AMONG ECLIPSING BINARIES c89
K. D. Abhyankar *In its* Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 4 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Light time effect can be used for detecting additional components in eclipsing binaries. One way to test their existence would be to consider the stability of such hierarchical systems. It is found that the triple systems are stable, but higher order multiple systems are not. Hence the three body model of AK Her proposed by Barker and Herczeg (1979) is more plausible than the four body model suggested by Abhyankar and Panchatsaram (1982). Author

N86-28836# Uttar Pradesh State Observatory, Naini Tal (India).
RS CVn BINARIES c89
J. B. Srivastava *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 15 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

The observational properties of RS CVn binaries which are known to eclipse are discussed. Thirty-five RS CVn type binaries are listed with their references. The references were collected from 1978 until September 1983. B.G.

N86-28837# Osmania Univ., Hyderabad (India). Centre for Advanced Study in Astronomy.
MODELS FOR RS CVn BINARIES c89
P. Vivekananda Rao and M. B. K. Sarma *In its* Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 6 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Photometric studies of RS CVn binaries during the last two to three decades have revealed interesting results which indicate that most of these stars exhibit a sinusoidal wave-like distortion in their light curves with amplitudes of up to 0.3 m and periods which are in general equal to the orbital period. Three models which explain this phenomena are discussed: extinction of the light by the hotter component by circumstellar material (Catalano and Rodona); pulsation of one of the components with the same period as that of the orbit; and the spot hypothesis (Hall 1972, Oliver 1974). B.G.

N86-28838# Indian Inst. of Astrophysics, Bangalore.
REFLECTION EFFECT IN CLOSE BINARIES c89
A. Peraiah *In* Osmania Univ. Proceedings of the Platinum Jubilee

Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 20 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Binary stars occupy an important place in the study of structure and evolution of stars. Changes in the total light during the eclipsing of close pairs was noted. The total light is the sum of the light of the individual components and the mutually reflected light. If the components are very close, the reflected light will be a considerable fraction of the total light and therefore will have to be estimated very carefully. The calculation of the radiation field from the irradiated surface of the components in a binary system is explained. The problem is considered both from incidence from a point source and incidence from an extended source. B.G.

N86-28839# Osmania Univ., Hyderabad (India). Centre of Advanced Study in Astronomy.
BINARY AND MULTIPLE GALAXIES **c89**
G. M. Ballabh *In its* Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 7 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Galaxies commonly occur as members of pairs, triplets, and groups of higher order. Among the systems of galaxies, binary galaxies have attracted more attention due to their significant number and also due to the simplicity involved in their geometry, dynamics, and observations. The study of binary galaxies forms an important subject in extragalactic astronomy. Statistical analyses (masses, mass to luminosity ratios, and morphological type relationships) are discussed. The dynamical aspects of the galaxies are also discussed. B.G.

N86-28840# Cambridge Univ. (England). Inst. of Astronomy.
GALAXY CLUSTERING **c90**
William C. Saslaw *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 7 p Prepared in cooperation with Virginia Univ., Charlottesville and National Radio Astronomy Observatory, Charlottesville, Va. (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Starting in the late 1960s, galaxy counting and analysis became a major astronomical industry. Two developments stimulated this rebirth: high speed computers which made correlation analysis easy and fast measuring machines which can automatically identify galaxies on plates and measure their coordinates accurately. The two point correlation function is discussed. Galaxy formation and clustering is explained using both the pancake picture and hierarchical clustering models. B.G.

N86-28841# Tata Inst. of Fundamental Research, Bombay (India).
GRAVITATIONAL LENSES AND MULTIPLE QUASARS **c89**
S. M. Chitre *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 6 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

The Very Long Base Interferometry features observed in the quasar Q0957+561 A,B are incorporated in a gravitational lens model. The observed quasar configuration was modeled by prescribing the core-radii, ellipticities, major axis, position angles of the lens galaxy and the background cluster, and also specifying the position of image A and its core-jet structure. The observed position and intensity of image B and its core-jet for a given choice of the position of the cluster center was fitted into the model. The effective time delay between components A and B is shown to be of the order of one year and the observed intensity variation in B is demonstrated to arise from the action of minilensing by a low-mass star. B.G.

N86-28842# Tata Inst. of Fundamental Research, Bangalore (India). Radio Astronomy Centre.
JETS IN QUASARS **c89**
D. J. Saikia *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 16 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Powerful extended extragalactic radio sources usually contain two lobes of radio emission on either side of the parent optical galaxy or quasar. Often a compact radio core coincident with the optical object is also detected. The consensus of opinion states that energy is transported to the outer lobes by collimated beams of fluid squirting from active galactic nuclei. The detection of radio jets in a large number of sources has provided the most direct evidence in support of such a scenario. The properties of jets from quasars are reviewed and their apparent one-sideness is described in some detail. B.G.

N86-28843# Tata Inst. of Fundamental Research, Bombay (India).
RADIO AND X-RAY EMISSION IN RADIO-LOUD QUASARS **c90**
Ajit Kembhavi *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 10 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

The launch of the Einstein X-ray Observatory has led to a tremendous increase in the knowledge of the X-ray properties of quasars. Prior to the new data, only 3 quasars were known to be X-ray emitters. The number of quasars on which X-ray observations are now available is about 400. Of these, about 200 were observed by Einstein in the pointing mode and the rest were observed serendipitously in the X-ray fields of other targets of interest. The observations from the Einstein X-ray Observatory are used to explain the behavior of quasars and active galactic nuclei models. B.G.

N86-28844# Indian Inst. of Astrophysics, Bangalore.
MINOR PLANETS AND PLANETARY RINGS **c91**
J. C. Bhattacharyya *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 10 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

Circumstances of the discovery of the first asteroid and the characteristics of various asteroid orbits are discussed. The shapes, compositions, and evolutionary histories were also described. The present status of knowledge about the rings surrounding the three giant planets are reviewed. Author

N86-28845# Tata Inst. of Fundamental Research, Bombay (India).
NATURE OF COMETS **c90**
K. S. Krishna Swamy *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 14 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

The present status of understanding about the origin, nature, and composition of comets was discussed in terms of the nucleus, coma, abundance analysis, isotopic ratios, parent molecules, cometary dust, and ionic composition of the tail. B.G.

N86-28846# Raman Research Inst., Bangalore (India).
NON-LTE PROCESS IN THE INTERSTELLAR MEDIUM **c90**
K. R. Anantharamaiah *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 7 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

An understanding of the thermodynamic processes occurring in the interstellar medium is necessary for the interpretation of many observed phenomena. The basic concepts of thermodynamic equilibrium are discussed. Local thermodynamic equilibrium (LTE) and departures from it, generally referred to as non-LTE, are described with a few examples of their occurrence in the interstellar medium. The importance of non-LTE processes in formation of low frequency radio recombination lines such as those

observed recently using the Ooty radio telescope are examined. B.G.

N86-28847# Tata Inst. of Fundamental Research, Bombay (India).
IMPLICATIONS OF X-RAY AND UV RADIATION ON INTERSTELLAR MEDIUM **c93**
K. P. Singh *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 15 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

The hot interstellar medium (HISM) was observed by ultraviolet absorption lines of highly ionized ions such Si-IV, C-IV, N-V, and O-VI and by the diffuse component of soft X-rays. The excess soft X-ray component is examined to understand its origin, and how it relates to the observation of the interstellar medium in other wavebands. B.G.

N86-28848# Indian Inst. of Astrophysics, Bangalore.
ABUNDANCE GRADIENT IN INTERSTELLAR MEDIUM **c90**
Sunetra Giridhar *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 13 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

The implications of observed abundance gradient in the interstellar medium on the chemical evolution of the Galax is reviewed. The gradients that are required to develop enrichment models are described and also the predictions of different models on the variation of metallicity in the galactic disk. The observed gradient, derived using different kinds of objects, is summarized. A few observations that are relevant to the problem of chemical evolution (like the G dwarf problem and the abundance ratios of the elements formed by primary and secondary processes of nucleosynthesis) are also briefly discussed. Some of the advanced models of chemical evolution that are able to account for all these observations are explained. It is necessary to extend the metallicity surveys to the outer most parts of the galactic disk since there is evidence that the chemical evolution of these parts was radically different from that of the solar neighborhood. The addition constraint imposed by such observations would lead to a more comprehensive theory of the chemical evolution of the galactic disk. Author

N86-28849# European Space Agency, Paris (France).
THE ATMOSPHERES OF SATURN AND TITAN
Erica Rolfe, ed. and Bruce Battrick, ed. Dec. 1985 319 p Partly in ENGLISH and FRENCH Workshop held in Alpabach, Austria, 16-19 Sep. 1985; sponsored by ESA and Austrian Solar and Space Agency
(ESA-SP-241; ISSN-0379-6566; ESA-86-96852) Avail: NTIS HC A14/MF A01

Sounding of the Saturn and Titan atmospheres by the Cassini probe was discussed. The chemistry and physics of their upper atmospheres, and the organic chemistry of Titan were considered. Complementary observations from Earth were treated. For individual titles, see N86-28850 through N86-28885. ESA

N86-28850# Arizona Univ., Tucson. Lunar and Planetary Lab.
INTERIOR OF SATURN **c91**
Jonathan I. Lunine *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 11 p Sponsored by Arizona Univ., Tuscon (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Observational and theoretical constraints used to model giant planet interiors are reviewed. The vertical distribution of elements heavier than helium (Z-elements) and the abundance and rainout of helium in the interiors of Jupiter and Saturn are considered. Models of the interior of Saturn are limited by the low accuracy of data on the gravitational moments of the planet and large uncertainties in atmospheric composition. This is in contrast to Jupiter, for which the gravitational moments are better known and thus the behavior of hydrogen and helium at high pressure is a driving uncertainty. The Galileo probe will provide highly accurate data on the abundances of helium and minor constituents in Jupiter's troposphere. Cassini will accurately determine the tropospheric helium abundance and improve the precision of the gravitational moment data, and hence permit interior models of Saturn of the same resolution as those of Jupiter. ESA

N86-28851# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
THE COMPOSITION OF SATURN'S ATMOSPHERE **c91**
R. Courtin *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 13-20 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The abundance determinations for the gaseous constituents of Saturn's atmosphere are reviewed. They show that helium is significantly depleted in the outer atmosphere, an important finding for Saturn's interior and heat balance. Saturn's atmosphere is enriched in volatiles CH4, NH3, and PH3, although rather large uncertainties remain on the CH4 and NH3 mixing ratios. Except for PH3, little information is available on species considered to be diagnostic of disequilibrium processes (GeH4, HCN, CO). Determinations of C2H2 and C2H6 mixing ratios and of their variations with latitude/altitude yield constraints for the modeling of photochemical (or other) processes in the stratosphere. The deuterium abundance derived from CH3D lines is close to the value obtained for the protosolar nebula. Implications of Saturn's composition for the origin and evolution of the planet are outlined. ESA

N86-28852# Observatoire de Paris-Meudon (France).
THERMAL STRUCTURE OF SATURN'S ATMOSPHERE **c91**
B. Bezard *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 21-31 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Knowledge of the thermal structure of Saturn is surveyed. At midlatitudes, the radiative-convective boundary is located around 700 mbar. At the top of the convective zone, the temperature lapse rate indicates incomplete equilibration of ortho and para H2. Seasonal radiative models give a good representation of the stratospheric part of the temperature profiles and of the large-scale hemispheric asymmetry observed at tropopause levels at the Voyager encounter. Small-scale meridional gradients imply a decrease of the zonal winds with height above the 300 mbar level. Observational prospects with the Cassini mission are discussed. ESA

N86-28853# Imperial Coll. of Science and Technology, London (England). Center for Remote Sensing and Atmospheric Physics
THE METEOROLOGY OF SATURN **c47**
Garry E. Hunt *In* ESA The Atmospheres of Saturn and Tital Dec. 1985 p 33-40 Sponsored by UK Science and Engineering Research Council (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The meteorology of Saturn and related Jovian properties which provide insight into the generation and maintenance of the complex motions which occur in these major planetary atmospheres are reviewed. Interior structure, atmospheric structure, large scale motions, atmospheric circulation, and the maintenance of dynamical systems are considered. The impact of the Cassini mission and other spaceborne astronomy missions is discussed. ESA

N86-28854*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
THEORIES FOR THE GENERAL CIRCULATION OF SATURN'S ATMOSPHERE **c91**
Michael Allison *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 43-52 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The circulation of Saturn's cloud-top winds is discussed. According to one class of theories, the multiple jet streams are confined to a shallow geostrophic wind layer supported by horizontal gradients in temperature and composition. According to an alternate view the jets extend all the way through the molecular fluid envelope on convectively driven cylinders of motion concentric

with the planetary spin axis. Both types of theories require as a starting point assumptions about the buoyancy contrast and eddy fluxes at levels thus far inaccessible to observation. The questions confronted by current theories suggest important reconnaissance objectives for the proposed Cassini mission to Saturn. ESA

N86-28855# Arizona Univ., Tucson. Lunar and Planetary Lab.
CLOUDS AND AEROSOLS ON SATURN **c91**
M. G. Tomasko and L. R. Doose *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 53-61 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Information on the distribution and optical properties of cloud and aerosol particles in Saturn's atmosphere is summarized. Small particles, possibly produced by photochemical reactions or energetic particle bombardment, are present between the 30 and 70mb levels at low latitudes, and above the 20mb level at latitudes > 60 deg. Several optical depths of larger, negatively polarizing particles are present over much of the planet between the 50mb level and the radiative-convective boundary near 400mb. Evidence suggests a relative cloud clearing between this level and an expected relatively dense ammonia cloud near the 1.4 bar level. The presence of a relative clearing between the 500mb level and the 1 bar level suggests that the particles found above the 400mb level are photochemical products rather than ammonia crystals. ESA

N86-28856*# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
UPPER ATMOSPHERE AND IONOSPHERE OF SATURN **c91**
S. K. Atreya (Michigan Univ., Ann Arbor.) *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 63-68 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Physical and chemical processes and measurements of the upper atmosphere and ionosphere of Saturn are reviewed. The discrepancies between ionospheric models and measurements are underlined. Issues to be addressed by the Cassini mission to Saturn are listed. ESA

N86-28857# Arizona Univ., Tucson. Lunar and Planetary Lab.
LIGHTNING ON SATURN **c47**
Donald M. Hunten *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 69-71 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Observational evidence and theories on lightning on Saturn are reviewed. The expected water and ice cloud layer in the 15 to 20 bar region is a suitable medium, especially by analogy with Jupiter where lightning is unequivocally observed. Saturn electrostatic discharges observed by Voyager are most naturally explained as due to lightning, although there are difficulties with the radio frequency spectrum and the required behavior of the ionosphere. The corresponding optical flashes and whistlers found at Jupiter are absent. ESA

N86-28858# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
THE COMPOSITION OF THE TITAN ATMOSPHERE **c91**
Daniel Gautier *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 75-81 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Abundances of major components of the Titan atmosphere as well as vertical and horizontal distributions of stratospheric compounds are discussed. Implications of the presence of oxygen compounds are considered. Monodeuterated methane is the only detected isotope. The possibility, based on laboratory simulations, of the formation of complex organics in the stratosphere is mentioned. ESA

N86-28859# Arizona Univ., Tucson. Lunar and Planetary Lab.
TITAN'S SURFACE: NATURE AND IMPLICATIONS FOR CASSINI **c91**
Jonathan I. Lunine *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 83-88 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

A model for a mixed ethane-methane-molecular nitrogen surface ocean is proposed to reconcile Voyager data on the lower atmosphere of Titan with understanding of the photolytic destruction of methane in the stratosphere. Such a reservoir would strongly affect the atmosphere and underlying water ice bedrock of Titan, and has profound implications for the evolution of Saturn's giant moon. Understanding of the interior and atmosphere of Titan depends upon the capability of Cassini spacecraft to determine the nature of the surface on a global scale. ESA

N86-28860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL STRUCTURE AND METEOROLOGY OF TITAN **c91**
Barney J. Conrath *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 89-94 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Knowledge of the thermal structure and meteorology of Titan are reviewed. Atmospheric temperature determinations, from Voyager radio occultation and infrared spectroscopy measurements, provide the principal observational constraints on the atmospheric dynamic regime. Titan is the second known example, along with Venus, of cyclostrophic zonal wind balance with upper stratospheric winds a factor of 10 greater than the equatorial surface velocity. Possible contributions of the Cassini Mission to understanding of Titan's meteorology are discussed. ESA

N86-28861*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
ZONAL WIND IN THE STRATOSPHERE OF TITAN **c91**
C. B. Leovy (Washington Univ., Seattle.) *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 95-98 Sponsored by NASA (For primary document see N86-28849 19-88)
(Grant NSG-7085)
Avail: NTIS HC A14/MF A01

Analogies between the zonal wind systems in the stratospheres of Venus and Titan are examined. Venus' super-rotation wind speed is close to the value that maximizes zonal momentum pumping by the semidiurnal thermal tide. If Titan's zonal wind also maximizes pumping by this tide, the maximum equatorial super-rotation wind speed is 100 m/sec. On Venus a zonal jet structure is superimposed on the background super-rotation. It is shown that a simple scaling relation describes well the speed and latitude of low latitude jets on planets from Venus to Saturn. Applied to Titan, this scaling predicts a jet speed of 10 to 20 m/sec in the latitude belt 30 to 40 deg superimposed on the background super-rotation. ESA

N86-28862*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOUDS AND AEROSOLS OF TITAN'S ATMOSPHERE **c91**
Robert E. Samuelson *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 99-107 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Voyager and Pioneer data on Titan's atmosphere are reviewed. Titan's cloud structure appears to consist of three basic components: a photochemical aerosol pervading the stratosphere between altitudes of 40 and 350 km; a mixture of condensed hydrocarbons and nitriles in the lower stratosphere, probably thickest between 50 and 80 km; and methane clouds between 10 and 35 km. Polarimetry, photometry, and infrared spectroscopy provide the basic data for inferring aerosol particle sizes and vertical structure. Properties of the condensates are inferred from infrared spectroscopy and radio occultation data. ESA

N86-28863*# Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies.
PHASE EQUILIBRIA IN N2-HYDROCARBON SYSTEMS: APPLICATIONS TO TITAN **c91**
W. Reid Thompson *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 109-119 Sponsored by NASA (For primary document see N86-28849 19-88)

(Grants NGR-33-010-220; NGR-33-010-082)
Avail: NTIS HC A14/MF A01

Phase equilibria in the N2-CH4-C2H6-C3H8 system are modeled using an expression for activity coefficients in multicomponent systems. An accurate quantitative model of the behavior of this system is important to considerations of the ocean-atmosphere, atmosphere-cloud, and thermal equilibria in the troposphere of Titan. In the model, the interrelationship between the tropospheric gas phase CH4 abundance, the ocean composition, and temperature is well defined. Given two of these three (and the total pressure), the third variable is fixed. Given a surface inventory of any one component, the total ocean depth is also fixed. A Titan ocean seems likely, is of a single liquid phase, and is involved in a strong feedback couple with the tropospheric temperature through the thermal opacity of CH4. A large part of this opacity is contributed by the clouds, which are a liquid solution of 15 to 25 mol% N2 in CH4 below 16 km, a solid solution of 13 to 26 mol% N2 in CH4 above, and are present at a column density 0.7 gm sqcm. ESA

N86-28864# Graz Univ. (Austria). Space Research Inst.
THE UPPER ATMOSPHERE OF TITAN **c91**
S. J. Bauer *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 125-128 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Voyager 1 observations determined the predominance of N2 in Titan's upper atmosphere, its exospheric temperature, and its minor species. Electron impact on N2 within Saturn's magnetosphere appears to be the main source of the airglow emissions and of an undetected ionosphere. Escape of hydrogen from Titan seems to supply the hydrogen torus in the Saturn system, while nonthermal escape of nitrogen can account (partially) for mass loss of Titan's atmosphere since the origin of the solar system. ESA

N86-28865# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
TITAN'S HYDROGEN TORUS **c91**
W.-H. Ip *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 129-141 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Observational results and theoretical models concerning the configuration and dynamics of the Titan hydrogen torus are reviewed. The formation of other neutral gas clouds (H2, O, and N) and their physical interrelations are emphasized. The exosphere of Titan as an interface between the hydrogen torus and the ionosphere/upper atmosphere driving the synthesis of complex nitriles important to prebiotic chemistry is outlined. A combination of the orbiter measurements in the Saturnian system at large and during close encounters with Titan (with a comprehensive package of aeronomic and magnetospheric instruments) is well suited for detailed investigation of this wide range of interlocking issues. ESA

N86-28866*# Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
PHOTOCHEMISTRY OF TITAN **c91**
Darrell F. Strobel *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 145-148 Sponsored by NASA (For primary document see N86-28849 19-88)
(Grant NAGW-646)
Avail: NTIS HC A14/MF A01

The photochemistry of Titan's atmosphere is reviewed in the light of the Voyager Mission. The escape rate of hydrogen from Titan is controlled by photochemical production from hydrocarbons. Methane is irreversibly converted to less saturated, complex hydrocarbons which accumulate over geologic time on the surface to form an C2H6 ocean with dissolved CH4, N2, and trace organic molecules and solid C2H2 residing at the bottom of the ocean. Scientific problems which the Cassini Mission can address are discussed. ESA

N86-28867*# Hawaii Univ., Honolulu. Inst. for Astronomy.
TELESCOPIC STUDIES OF THE SATELLITES OF SATURN **c89**
Dale P. Cruikshank *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 14-156 Presented at Workshop on Solid Bodies of the Outer Solar System, Vulcano, Italy, 9-13 Sep. 1985 (For primary document see N86-28849 19-88)
(Grant NGL-12-001-057)
Avail: NTIS HC A14/MF A01

Surface composition of Saturn's satellites (except Titan) as revealed by Earth based telescopes is discussed. Most of the satellites are icy objects with nearly pure frozen water on their surfaces. Notable exceptions are the dark hemisphere of Iapetus and the captured object Phoebe. Small amounts of nonwater contaminants may occur in the surface ices of several of the larger satellites, and Hyperion may contain a large amount of contaminant. Many unresolved questions about the nature of the Saturn satellite system remain for in situ studies by an orbiting spacecraft. ESA

N86-28868# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Flugmedizin.
EXOBIOLOGICAL ASPECTS IN VIEW OF TITAN **c55**
G. Horneck *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 157-159 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Contributions of Cassini mission data on Titan's atmosphere to exobiology are discussed. Cassini can study the nature, abundance and degree of complexity of organic molecules including the occurrence of chirality in the clouds, on the surface of Titan, or submerged in its ocean; the transient stages and the mechanisms of organic molecule formation; and the similarities of organic compounds and of their formation processes from different cosmic sources. ESA

N86-28869# Paris-Val de Marne Univ., Creteil (France). Lab. de Physicochimie de l'Environnement.
ORGANIC CHEMISTRY ON TITAN: LABORATORY SIMULATIONS AND SPECULATION [CHIMIE ORGANIQUE DANS TITAN: EXPERIENCES DE SIMULATION EN LABORATOIRE ET SPECULATIONS] **c23**
F. Raulin *In* ESA The Atmospheres of Saturn and Tital Dec. 1985 p 161-173 In FRENCH (For primary document see N86-28849 19-88)
(Contract CNES-85-1251)
Avail: NTIS HC A14/MF A01

Laboratory simulations were used to list volatile organic composites likely to be present in Titan's atmosphere in considerable quantities. Minimum mass volumes were established for products solid at 94K, and saturation concentrations (Cm) in a variable ethane-methane solution at 94K were calculated. Results show that all the simple organic composites solidified on the surface of Titan, if it is made of such a solvent, form sediment at the bottom of the ocean. The Cm values indicate that saturation should be attained for most of the concentrations in the range 1 to 10-5 M. Ocean composition as a function of the binary mixture ethane-methane is discussed. ESA

N86-28870# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Chimie 1.
HOT ATOM CHEMISTRY AND RADIOLYSIS OF GASEOUS AND SOLID COMPONENTS OF PLANETARY ATMOSPHERES **c45**
K. Roessler *In* ESA The aTmospheres of Saturn and Titan Dec. 1985 p 175-188 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Particles with kinetic energies exceeding a few eV found in space are discussed. They induce chemical reactions different from those considered in cosmic chemistry hitherto and include endothermic reactions with high activation energies and atom-molecule interactions. This hot atom chemistry leads to the formation of molecules in rings and icy surfaces as well as in the upper atmosphere of planets and satellites. An important contribu-

tion comes from secondary particles generated by cosmic rays in the deeper layers of the atmospheres and the oceans. Laboratory simulation is performed by ion implantation and optical spectroscopy, chemical sputtering, mass spectroscopy, nuclear recoil techniques, and radiochromatography. The variation of the chemical products with the radiation dose gives information on radiation chemistry in space. ESA

N86-28871# Centre National de la Recherche Scientifique, Orleans (France). Centre de Biophysique Moleculaire.
SEARCH FOR CHIRAL MOLECULES AND OPTICAL ACTIVITY IN EXTRATERRESTRIAL SYSTEMS. THE CASSINI MISSION OPPORTUNITY c55
Andre Brack and Gerard Spach (Rouen Univ. France) *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 189-191 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The genesis of homochiral systems and the conditions which dictate the choice of a given set of enantiomers rather than the antipode are discussed. Examination of extraterrestrial organic molecules may give clues if life based on carbon chemistry is sought. Where life is expected to exist (Mars), the detection of optical activity may be a good indication of its presence. The situation is different on Titan which is still in its phase of chemical evolution. The most simple possible derivatives devoid of oxygen atoms are listed. Search for optical activity on Titan raises difficult technical problems which, once solved, may be helpful for further exploration of other planets. ESA

N86-28872# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
GROUND-BASED HIGH RESOLUTION SPECTROSCOPY OF SATURN AND TITAN c89
Catherine deBergh *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 195-202 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Ground based spectroscopic studies of Saturn determined the C/H ratio and D/H ratio in methane, the C12/C13 ratio, and the D/H ratio in hydrogen. The characteristics and location of the upper cloud layers were studied. Methane absorptions were used to interpret Titan spectra. Millimetric studies of PH3 vertical distribution and signatures of species such as HCP were unsuccessful. Carbon monoxide is detected on Titan at 1.6 microns. The D/H ratio in methane was measured, also at 1.6 microns, contributing to knowledge of the origin of deuterium in the Solar System. ESA

N86-28873# California Univ., Berkeley. Dept. of Astronomy.
VLA-OBSERVATIONS OF SATURN: CAN WE DO BETTER FROM SPACE c89
Imke dePater *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 203-208 (For primary document see N86-28849 19-88) (Grant NSF AST-84-05358)
Avail: NTIS HC A14/MF A01

High resolution radio observations of Saturn obtained with the VLA at different wavelengths and different viewing aspects of the ring plane are discussed. Deficiencies of ground based observations in general and interferometric (VLA) observations in particular are emphasized. Two major problems are identified: the uncertainties of the absolute flux calibration, and the relatively low dynamic range obtained in ground-based planetary maps. Observations from space with a much smaller telescope (1 m) in orbit around Saturn can alleviate these problems and aid studies of Saturn's atmosphere and rings. ESA

N86-28874# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France).
THE CASSINI MISSION: COMPLEMENTARY OBSERVATIONS WITH THE SPACE TELESCOPE c89
Renee Prange *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 209-217 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The Space Telescope and its five focal instruments are presented and their characteristics ar summarized. Choice of an instrument for a given observation is discussed. Observations of the Saturn and Titan atmospheres, including Saturn's photochemistry, atmospheric circulation, center-to-limb variations, D/H ratio, H2 emissions, auroras, rings, icy satellites, and spokes by the Space Telescope are suggested. For Titan, observations of the nitrogen atmosphere, prebiotic molecules, and the hydrogen torus are proposed. ESA

N86-28875# State Univ. of New York, Stony Brook. Earth and Space Science Dept.
EARTH-ORBITING TELESCOPES IN THE CASSINI ERA c89
John Caldwell *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 219-222 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Two satellites expected to provide important observational capability for planetary studies before and during the operational phase of the Cassini project are described: the Hubble Space Telescope, and the Far Ultraviolet Spectroscopic Explorer. For the former, initial complement of instruments; initial observing plans; and prospects for second generation instruments are discussed. For the latter telescope, desired features are listed. ESA

N86-28876*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Space Science Dept.
THE CASSINI MISSION TO SATURN AND TITAN. AN OVERVIEW c12
Jean-Pierre Lebreton *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 225-232 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The Cassini mission to Saturn and Titan scientific and technical aspects are summarized. The mission will study Saturn's atmosphere, rings, icy satellites, and magnetosphere. It will study Titan's atmosphere (abundances, gas distributions, winds and temperature, upper atmosphere) and surface composition. Cassini is planned for launch in May 1994 by the Space Shuttle. The combined Orbiter and Probe will be delivered to Saturn via a delta-Vega trajectory which requires a flight time of 7.7 yr. Opportunities for asteroid flybys occur twice during the interplanetary cruise to Saturn. Upon arrival at Saturn in January 2002, the Orbiter and Probe combination will be placed into an initial 3 months orbit. Near the end of this first orbit, the Orbiter will target the Probe for delivery to Titan. During the Probe mission, the Orbiter will act as a data relay station, transmitting the Probe data to the Earth. ESA

N86-28877*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE TOUR DESIGN FOR THE CASSINI MISSION c12
Roger E. Diehl *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 233-243 Presented at Workshop on Solid Bodies of the Outer Solar System, Vulcano, Italy, 9-13 Sep. 1985 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The mission design for the Cassini satellite tour of Saturn is described. The use of Titan encounters for gravity-assisted trajectory shaping to satisfy atmosphere, magnetosphere, and satellite science requirements is discussed. Three candidate satellite tours that illustrate the tradeoffs between different strategies to satisfy the science objectives are presented. Tour characteristics for a 4yr mission include at least 30 Titan encounters to provide a minimum of 90 deg orbit rotation for either a magnetotail petal orbit or noon petal orbit; evenly distributed Titan ground tracks for radar mapping coverage; at least 2 Iapetus and 1 Enceladus close flybys; inclined orbits during the first 3 yr to provide Earth and Sun occultations by Saturn and its rings; and Polar orbits during the fourth year. ESA

N86-28878*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CASSINI-TITAN PROBE CONCEPT **c18**
G. E. N. Scoon *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 245-260 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The Cassini mission Titan Probe is modular in design, provides the necessary accommodation for the scientific instruments, and has the dynamic performance needed to withstand the environmental loads associated with a targeted entry into Titan's atmosphere. Cassini target launch date is in May 1994 using the Space Shuttle/Centaur G Prime launch vehicle. The combined Orbiter and Probe spacecraft is delivered to the Saturn system via a delta-Vega trajectory, which requires a flight time of 7.7 yr. Opportunities for asteroid flybys will occur as the spacecraft traverses the asteroid belt, which happens twice during the interplanetary cruise to Saturn. Arrival at Saturn is predicted for January 2002, when the Orbiter and Probe combination will be placed into an initial 3 month orbit. Near the end of this first orbit, the Orbiter targets the Probe for separation and delivery to Titan. ESA

N86-28879*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CASSINI: THE IMAGING EXPERIMENT **c12**
Torrence V. Johnson *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 261-265 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Imaging techniques for Cassini mission objectives in Saturn atmosphere, Titan atmosphere, satellites and rings, and magnetosphere are discussed. The Cassini strawman payload suggests at least two imaging systems, a long focal length, narrow angle camera and a shorter focal length, wide angle camera. The sensors will be CCD chips with large dynamic range, linear response, and infrared sensitivity (to 1.0 micrometers). The Galileo 1500 mm focal length system with an 800x800 CCD forms the basis of at least one design which could meet the high resolution requirements of Cassini. However, since the Cassini orbiter is planned to be the second Mariner Mark 2 spacecraft, the final camera design will be influenced by the facility imaging system planned for the CRAF mission, the first Mariner Mark 2. As planned, this is a combination of a narrow and a wide angle camera designed for improved performance and lower weight compared to the Galileo system. ESA

N86-28880# California Inst. of Tech., Pasadena.
MICROWAVE SPECTROSCOPY AND RADIOMETRY OF SATURN AND TITAN **c89**
Duane O. Muhleman *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 267-279 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Experiments using microwave emission techniques for the investigation of the deep atmosphere of Saturn, the ring system, and the entire atmosphere of Titan and its surface are described. A microwave spectrometer and radiometer system is being designed for the Cassini mission. It would sound the atmosphere of Saturn in the 0.5 to 15 bar pressure range at wavelenghts of 2 and 13 cm. It would map Saturn's ring in thermal emission at wavelengths of 3 mm and 2 cm and measure the polarization of the scattered radiation at 2 cm. A system consisting of 1 or 2 receivers to sound the atmosphere of Titan from the cold trap to 500 km altitude to determine temperature, pressure of the atmosphere as a function of altitude, and mixing ratio profiles of certain species is discussed. Surface emission of Titan at 2 cm is considered. ESA

N86-28881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL MASS SPECTROMETRY AND GAS CHROMATOGRAPHY **c89**
Hasso B. Niemann *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 271-279 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Astronomical uses of mass spectrometers and gas chromatographs are reviewed. Mass spectrometers were employed to measure the chemical composition of the atmospheres of Mars and Venus, and a mass spectrometer is part of the Galileo mission to Jupiter. Gas chromatographs were used successfully on the Pioneer Venus mission and on the Venera 11 and 12 missions. The only gas chromatograph-mass spectrometer combination ever flown in a planetary mission was on the Viking Lander. A gas chromatograph-mass spectrometer system which alternatively takes atmospheric gas samples directly into the mass spectrometer, or indirectly through a chromatographic column, or an aerosol pyrolyzer, is proposed for the analysis of the atmosphere of Titan using an entry probe. ESA

N86-28882# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
AN AEROSOL COLLECTOR PYROLYSER FOR THE CASSINI TITAN PROBE **c19**
Guy Israel *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 281-286 Sponsored by SNIAS (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Aerosol sampling during the descent of a Titan probe, as proposed in the Cassini mission, is recommended. The preferred analytical method is pyrolysis in which the gas products can be identified by the mass spectrometer and/or mass spectrometer-gas chromatograph instruments which will be part of the probe payload. Sampling aerosols in the region 60 to 30 km seems the best way to determine the nature and importance of the organic polymers incorporated in the aerosols of the condensed clouds. Another region for sampling is envisaged in the upper part of the atmosphere (200 to 70 km). Studies on the collecting plates, and the pneumatic and mechanical systems are described. ESA

N86-28883# Arizona Univ., Tucson. Lunar and Planetary Lab.
AERONOMICAL MEASUREMENTS BY CASSINI **c91**
Donald M. Hunten *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 287-288 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

The capability of the instruments on the proposed Cassini payload to make in-situ and remote measurements of Titan's upper atmosphere is discussed. The multiple fly-throughs of the Orbiter at heights well below the ionospheric peak offer an opportunity for detailed aeronomical studies of this atmosphere. They will be supplemented by solar and stellar occultations and measurements of airglow and aurora on Titan and Saturn. ESA

N86-28884# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Astrofisica Spaziale.
THE DISCOVERY OF THE SATURN SYSTEM: CASSINI'S LIFE AND ACTIVITY **c99**
Marcello Fulchignoni *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 289-294 Presented at Workshop on Solid Bodies of the Outer Solar System, Vulcano, Italy, 9-13 Sep. 1985 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Cassini's life and activity are reviewed. His discovery of Iapetus, Rhea, Thetys, and Dione, and his description of the gap in the Saturn ring (Cassini division) are described. ESA

N86-28885# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
INFRARED SPECTROSCOPY ABOARD CASSINI **c89**
Daniel Gautier *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 297-305 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

Information on thermal structures and compositions of Saturn

and Titan atmospheres which can be retrieved from spectroscopy of the far infrared, submillimeter, and microwave spectra emitted by these objects is analyzed. The corresponding instrumentation proposed aboard the Orbiter of the Cassini mission is described. ESA

N86-28886# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
[ACTIVITIES REPORT OF THE ISTITUTE OF INTERPLANETARY SPACE PHYSICS] Annual Report, 1984 [RELAZIONE SULLATTIVITA SVOLTA NELLANNO 1984]
Mar. 1985 57 p In ITALIAN
(IFSI-85-3; ESA-86-97087) Avail: NTIS HC A04/MF A01

A cosmic ray detection station; a high altitude solar neutron detector; cosmic ray data analysis; tethered satellite systems; gravitational waves; Giotto satellite system; and infrared astronomy are discussed. ESA

N86-28887# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
PARTICIPATION OF THE INSTITUTE OF INTERPLANETARY SPACE PHYSICS (IFSI) IN THE STUDY OF HALLEY'S COMET [PARTECIPAZIONE DELL IFSI ALLO STUDIO DELLA COMETA DI HALLEY]
Jun. 1985 16 p In ITALIAN Original contains color illustrations
(IFSI-85-7; ESA-86-97091) Avail: NTIS HC A02/MF A01

The design of the Giotto satellite is discussed. The corresponding experiments include measurement of the energy and mass distribution of positive ions near the comet, high temporal resolution measurement of the magnetic field, observation of gas and particles in 10 different wavelengths by a dedicated design camera, ultraviolet measurements in the vicinity of the comet, and visible spectrum observations from Earth using a charged coupled device camera. ESA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-28888# Royal Observatory, Edinburgh (Scotland).
OCCASIONAL REPORTS OF THE ROYAL OBSERVATORY, EDINBURGH
1985 22 p
(ISSN-0309-099X; ESA-85-96548) Avail: NTIS HC A02/MF A01

A multiobject fiber-optics coupler for the 1.2 m UK Schmidt Telescope (UKST); the UKST plate scale;and a design for a large altazimuth Schmidt telescope are discussed. For individual titles, see N86-28889 through N86-28891.

N86-28889# Royal Observatory, Edinburgh (Scotland).
A MULTIPLE-OBJECT FIBRE-OPTICS COUPLER FOR THE 1.2 MICRON UK SCHMIDT TELESCOPE
F. G. Watson and J. A. Dawe *In its* Occasional Reports of the Royal Observatory, Edinburgh 1985 p 1-7 (For primary document see N86-28888 19-89)
Avail: NTIS HC A02/MF A01

The rationale for and design of a spectrograph coupler for a wide-field Schmidt astronomical telescope are presented. System performance is estimated as 0.14 overall transmission, compared to 0.23 for a Cassegrain reflector. ESA

N86-28890# Royal Observatory, Edinburgh (Scotland).
THE PLATE SCALE OF THE UK SCHMIDT TELESCOPE
R. W. Argyle and P. R. Standen *In its* Occasional Reports of the Royal Observatory, Edinburgh 1985 p 9-13 (For primary document see N86-28888 19-89)
Avail: NTIS HC A02/MF A01

Plate scales for 137 plates of the South Galactic Pole were derived. The effect on expansion coefficients of using dome temperatures or invar rod temperatures is discussed. ESA

N86-28891# Royal Observatory, Edinburgh (Scotland).
DESIGN FOR A LARGE ALTAZIMUTH SCHMIDT TELESCOPE
J. A. Dawe and F. G. Watson *In its* Occasional Reports of the Royal Observatory, Edinburgh 1985 p 15-18 (For primary document see N86-28888 19-89)
Avail: NTIS HC A02/MF A01

A case for the construction of a large altazimuth Schmidt telescope for ground-based optical astronomy is presented. The statistical nature of most astronomical research suggests that the use of a single, medium-sized optical train to look at many objects simultaneously is effective and cheap. ESA

N86-28892*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPARISON OF STAR FORMATION CHARACTERISTICS IN DIFFERENT TYPES OF IRREGULAR GALAXIES Final Technical Report
S. S. Lamb, D. A. Hunter (Carnegie Institution of Washington, D. C.), and J. S. III Gallagher (Kitt Peak National Observatory, Tucson, Ariz.) 8 Jul. 1986 5 p
(Grant NAG5-404)
(NASA-TM-88779; NAS 1.15:88779) Avail: NTIS HC A02/MF A01 CSCL 03A

Two regions of recent star formation in blue irregular galaxies were observed with the IUE in the short wavelength, low dispersion mode. The spectra indicates that the massive star content is similar in these regions and is best fit by massive stars formed in a burst and now are approximately 2.5 to 3.0 million years old. Author

N86-28893# Cambridge Univ. (England). Inst. of Astronomy.
[ACTIVITIES REPORT OF THE INSTITUTE OF ASTRONOMY] Annual Report, 1984-1985
1985 46 p
(ESA-86-97103) Avail: NTIS HC A03/MF A01

Research on the Sun and stars; star clusters; galaxies; galactic clusters; quasars; cosmology; relativity and fluid mechanics; and astrometry is summarized. ESA

N86-28894# Royal Greenwich Observatory, Herstmonceux (England).
CARLSBERG MERIDIAN CATALOG. LA PALMA NUMBER 1: OBSERVATIONS OF POSITIONS OF STARS AND PLANETS MADE IN THE YEAR 1984
1985 129 p Sponsored by Carlsberg Foundation, Danish Natural Science Research Council, and UK Science and Engineering Research Council Prepared in cooperation with Copenhagen University and Instituto y Observatorio Astronomico de Marina
(ESA-86-97121) Avail: NTIS HC A07/MF A01

The positions in the FK4 system for the equinox J2000.0, proper motions, and magnitudes of 5292 stars north of -45 deg declination are given. The stars include 2369 AGK3R, 1296 SRS, 227 PZT, and 838 faint reference stars around benchmark radio sources with a limiting magnitude of 13.5. The zenith mean errors are sigma alpha cos delta = 0'.193, sigma delta = 0'.184, and sigma m = 0m.054. The proper motion mean errors are typically 0'.003 per year. The catalog also contains 857 observations of solar system objects. Cross-references are given to DM, AGK3, SAO, HD, GC, and the double star catalogs ADS and IDS. ESA

N86-28895# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
OBSERVATION OF CENTAURUS A IN THE MeV GAMMA RANGE [BEOBACHTUNG VON CENTAURUS A IM MeV-GAMMABEREICH]
Peter vonBallmoos Dec. 1985 119 p In GERMAN
(MPE-193; ISSN-0178-0719; ESA-86-96934) Avail: NTIS HC A06/MF A01

The active galactic nucleus of Cen A was observed in the range of low energy (0.7 to 20 MeV) gamma radiation. The measurements were conducted in a balloon campaign using a Compton telescope. The identification of the source used an imaging technique called the pi-method. In order to simplify the source identification in the pi-charts, these are compared with

model charts resulting from Monte Carlo calculations. A thorough understanding of the telescope characteristics (especially the point image function) was decisive for the development of the pi-method. The determined spectral index and the magnitude of the excess agree very well with measurement in the hard X-ray range. The measurement, however, surprises by the significant photon flux in the high energy part of the spectrum, confirming that the luminosity of Cen A in the MeV gamma range is larger than in any other part of the electromagnetic spectrum. Three models to explain the measured spectrum are discussed. ESA

N86-28835# Osmania Univ., Hyderabad (India). Centre of Advanced Study in Astronomy.
MULTIPLICITY AMONG ECLIPSING BINARIES
K. D. Abhyankar *In its* Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 4 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28836# Uttar Pradesh State Observatory, Naini Tal (India).
RS CVn BINARIES
J. B. Srivastava *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 15 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28837# Osmania Univ., Hyderabad (India). Centre for Advanced Study in Astronomy.
MODELS FOR RS CVn BINARIES
P. Vivekananda Rao and M. B. K. Sarma *In its* Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 6 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28838# Indian Inst. of Astrophysics, Bangalore.
REFLECTION EFFECT IN CLOSE BINARIES
A. Peraiah *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 20 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28839# Osmania Univ., Hyderabad (India). Centre of Advanced Study in Astronomy.
BINARY AND MULTIPLE GALAXIES
G. M. Ballabh *In its* Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 7 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28841# Tata Inst. of Fundamental Research, Bombay (India).
GRAVITATIONAL LENSES AND MULTIPLE QUASARS
S. M. Chitre *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 6 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28842# Tata Inst. of Fundamental Research, Bangalore (India). Radio Astronomy Centre.
JETS IN QUASARS
D. J. Saikia *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 16 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28867*# Hawaii Univ., Honolulu. Inst. for Astronomy.
TELESCOPIC STUDIES OF THE SATELLITES OF SATURN
Dale P. Cruikshank *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 14-156 Presented at Workshop on Solid Bodies of the Outer Solar System, Vulcano, Italy, 9-13 Sep. 1985 (For primary document see N86-28849 19-88)
(Grant NGL-12-001-057)
Avail: NTIS HC A14/MF A01

N86-28872# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
GROUND-BASED HIGH RESOLUTION SPECTROSCOPY OF SATURN AND TITAN
Catherine deBergh *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 195-202 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28873# California Univ., Berkeley. Dept. of Astronomy.
VLA-OBSERVATIONS OF SATURN: CAN WE DO BETTER FROM SPACE
Imke dePater *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 203-208 (For primary document see N86-28849 19-88)
(Grant NSF AST-84-05358)
Avail: NTIS HC A14/MF A01

N86-28874# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France).
THE CASSINI MISSION: COMPLEMENTARY OBSERVATIONS WITH THE SPACE TELESCOPE
Renee Prange *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 209-217 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28875# State Univ. of New York, Stony Brook. Earth and Space Science Dept.
EARTH-ORBITING TELESCOPES IN THE CASSINI ERA
John Caldwell *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 219-222 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28880# California Inst. of Tech., Pasadena.
MICROWAVE SPECTROSCOPY AND RADIOMETRY OF SATURN AND TITAN
Duane O. Muhleman *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 267-279 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL MASS SPECTROMETRY AND GAS CHROMATOGRAPHY
Hasso B. Niemann *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 271-279 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28885# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
INFRARED SPECTROSCOPY ABOARD CASSINI
Daniel Gautier *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 297-305 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-28896*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Solar System Exploration Dept.
METASTABLE CARBON IN TWO CHONDRITIC POROUS INTERPLANETARY DUST PARTICLES
Frans J. M. Rietmeijer and Ian D. R. Mackinnon (New Mexico

Univ., Albuquerque.) 1986 15 p Submitted for publication (Contract NAS9-15800)
(NASA-CR-177200; NAS 1.26:177200; LEMSCO-22925) Avail: NTIS HC A02/MF A01 CSCL 03B

An understanding of carbonaceous matter in primitive extraterrestrial materials is an essential component of studies on dust evolution in the interstellar medium and the early history of the Solar System. Analytical Electron Microscopy (AEM) on carbonaceous material in two Chondritic Porous (CP) aggregates is presented. The study suggests that a record of hydrocarbon carbonization may also be preserved in these materials. B.G.

N86-28897*# Wisconsin Univ., Madison. Dept. of Physics.
LIMITS ON CORONAL MATERIAL IN NORMAL GALAXIES Final Technical Report, 1 May 1982 - 30 Apr. 1986
Dan McCammon Jul. 1986 38 p
(Grant NAG8-431)
(NASA-CR-177195; NAS 1.26:177195) Avail: NTIS HC A03/MF A01 CSCL 03B

Measurements of the X-ray surface brightness of a face on disk galaxy M101, have previously been used to place upper limits on the power radiated by a hot corona. Such analysis contrains the effective density of the disk; either it must be so low that the remnants drive a fast hot wind (low radiated power) or so high that the remnant temperature at overlap is low (low X-ray power). These X-ray measurements are here used to constrain the properties of the population of supernova remnants evolving in the disk. This adds a further constraint since young remnants evolving in higher density radiate more of their energy in X-rays, whether or not they eventually overlap to generate a hot corona. The strength of this second limit depends strongly on the density history of the remnants and on the assumed supernova rate. For evaporative evolution the analysis rules out McKee and Ostriker ISM model in particular and evaporative evolution in general unless the supernova rate is at least several times lower than current expectations. For standard Sedov evolutions, the density limit marginally admits evolution in 0.2 cu m, a popular alternative to the McKee and Ostriker model. Author

N86-28898*# Texas Univ., Austin. Dept. of Astronomy.
MOLECULAR CLOUDS IN THE OUTER GALAXY 1: FAR INFRARED OBSERVATIONS
Kathryn N. Mead, Marc L. Kutner, Neal J. Evans, II, Paul M. Harvey, and Bruce A. Wilking 1986 17 p Prepared in cooperation with Rensselaer Polytechnic Inst., Troy, N.Y.
(Grant NAG2-198)
(NASA-CR-177127; NAS 1.26:177127) Avail: NTIS HC A02/MF A01 CSCL 03B

From the Kuiper Airborne Observatory, far infrared emission were detected from 4 molecular clouds in the outer galaxy. Eleven areas in 6 clouds were observed at 50 and 100 microns. The far-infrared luminosities indicate the presence of stars with spectral types ranging from B3 to O7. Therefore, despite the fact that these clouds have lower CO line temperatures than comparable clouds in the inner galaxy, they are giving birth to massive stars. Author

N86-28899# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DUST PARTICLES DETECTED NEAR GIACOBINI-ZINNER BY THE ICE PLASMA WAVE INSTRUMENT Progress Report
D. A. Gurnett, T. F. Averkamp, F. L. Scarf, and E. Gruen 24 Jan. 1986 24 p
(Contract N00014-85-K-0404)
(AD-A165633; U-OF-IOWA-86-6) Avail: NTIS HC A02/MF A01 CSCL 03/1

During the International Cometary Explorer (ICE) flyby of Giacobini-Zinner the plasma wave instrument detected numerous impulsive signals caused by dust impacts on the spacecraft. Most of the impacts occurred within 30,000 km of the comet. The impact rate averaged over the inbound and outbound legs varies approximately as 1/r-square, as would be expected for an isotropic constant velocity radial outflow. Small differences between the inbound and outbound legs exist which may be indicative of azimuthal variations in the dust production rate. A simple model of the impact ionization and charge collection by the antenna indicates that the particles have a mass on the order of 10 to the -12th power to 10 to the -10th power gm, corresponding to particles with radii of a few microns. GRA

N86-28812*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METEORITE CONCENTRATION MECHANISMS IN ANTARCTICA
John O. Annexstad *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 23-25 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28813*# Pittsburgh Univ., Pa. Dept. of Geology and Planetary Science.
METEORITES AND THE ANTARCTIC ICE SHEET
W. A. Cassidy *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 26-27 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28814*# Smithsonian Institution, Washington, D. C. Div. of Meteorites.
ANTARCTIC IRON METEORITES: AN UNEXPECTEDLY HIGH PROPORTION OF FALLS OF UNUSUAL INTEREST
Roy S. Clarke, Jr. *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 28-29 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28815*# Federal Inst. for Geosciences and Natural Resources, Hannover (West Germany).
DISCOVERY OF METEORITES ON A BLUE-ICE FIELD NEAR THE FRONTIER MOUNTAINS, NORTH VICTORIA LAND, ANTARCTICA
G. Delisle, H.-C. Hoefle, R. Thierbach, and L. Schultz (Max-Planck-Inst. fuer Chemie, Main, West Germany) *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 30-33 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28816*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
MYSTERIOUS IODINE-OVERABUNDANCE IN ANTARCTIC METEORITES
G. Dreibus, H. Waenke, and L. Schultz *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 34-36 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28817*# Cambridge Univ. (England). Polar Research Inst.
ENTRAINMENT, TRANSPORT AND CONCENTRATION OF METEORITES IN POLAR ICE SHEETS
D. J. Drewry *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 37-47 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28818*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WEATHERING OF STONY METEORITES IN ANTARCTICA
J. L. Gooding *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 48-54 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28820*# Gakushuin Univ., Tokyo (Japan). Dept. of Chemistry.
RADIOCARBON DATINGS OF YAMATO METEORITES
K. Kigoshi and E. Matsuda *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 58-60 (For primary

document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28821*# Bern Univ. (Switzerland). Lab. fuer Radiochemie.
ELEMENT DISTRIBUTION AND NOBLE GAS ISOTOPIC ABUNDANCES IN LUNAR METEORITE ALLAN HILLS A81005
U. Kraehenbuehl, O. Eugster, and S. Niedermann *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 61-64 Sponsored in part by Swiss National Science Foundation (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28822*# Warsaw Univ. (Poland). Dept. of Chemistry.
THERMOANALYTICAL CHARACTERIZATION OF SEVERAL ANTARCTIC METEORITES
B. Lang, A. Grodzinski, and L. Stoch (Academy of Mining and Metallurgy, Cracow, Poland) *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 65-67 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28823*# Purdue Univ., West Lafayette, Ind. Dept. of Chemistry.
TRACE ELEMENTS IN ANTARCTIC METEORITES: WEATHERING AND GENETIC INFORMATION
M. E. Lipschutz *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 68-70 (For primary document see N86-28811 19-88)
(Grants NAG9-48; NSF DPP-81-11513; DEFG-0280-ER-10725)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28824*# California Univ., San Diego, La Jolla. Dept. of Chemistry.
TERRESTRIAL AND EXPOSURE HISTORIES OF ANTARCTIC METEORITES
K. Nishiizumi *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 71-73 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28826*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
RARE AND UNIQUE METEORITES FROM ANTARCTICA
H. Palme *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 77-79 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28827*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
TERRESTRIAL AGES OF ANTARCTIC METEORITES: IMPLICATIONS FOR CONCENTRATION MECHANISMS
Ludolf Schultz *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 80-82 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28828*# Arkansas Univ., Fayetteville. Dept. of Chemistry and Biochemistry.
THERMOLUMINESCENCE AND ANTARCTIC METEORITES
Derek W. G. Sears and Fouad A. Hasan *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 83-100 (For primary document see N86-28811 19-88)
(Grant NAG9-81)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28829*# Otago Univ., Dunedin (New Zealand). Dept. of Geology.
A PRELIMINARY REPORT ON A POSSIBLE STROMATOLITE FIND FROM THE ELEPHANT MORAINE, ANTARCTICA: A POTENTIAL DIRECTIONAL INDICATOR FOR ICE MOVEMENT
P. P. Sipiera and C. A. Landis *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 101-103 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28830*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.
THERMOLUMINESCENCE OF ANTARCTIC METEORITES: A RAPID SCREENING TECHNIQUE FOR TERRESTRIAL AGE ESTIMATION, PAIRING STUDIES AND IDENTIFICATION OF SPECIMENS WITH UNUSUAL PREFALL HISTORIES
S. R. Sutton and R. M. Walker *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 104-106 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28831*# Tokyo Univ. (Japan). Mineralogical Inst.
PARENT SOURCES OF ANTARCTIC METEORITES AS INFERRED FROM PAIRING OF THE SPECIMENS
Hiroshi Takeda *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 107-109 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28832*# Cologne Univ. (West Germany). Dept. of Nuclear Chemistry.
METEORITIC ABLATION AND FUSION SPHERULES IN ANTARCTIC ICE
K. Thiel, J. Peters, G. M. Raisbeck (Centre National de la Recherche Scientifique, Orsay, France), and F. Yiou *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 110-112 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28833*# National Inst. of Polar Research, Tokyo (Japan).
OVER 5,600 JAPANESE COLLECTION OF ANTARCTIC METEORITES: RECOVERIES, CURATION AND DISTRIBUTION
K. Yanai and H. Kojima *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 113-116 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28840# Cambridge Univ. (England). Inst. of Astronomy.
GALAXY CLUSTERING
William C. Saslaw *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 7 p Prepared in cooperation with Virginia Univ., Charlottesville and National Radio Astronomy Observatory, Charlottesville, Va. (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28843# Tata Inst. of Fundamental Research, Bombay (India).
RADIO AND X-RAY EMISSION IN RADIO-LOUD QUASARS
Ajit Kembhavi *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 10 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28845# Tata Inst. of Fundamental Research, Bombay (India).
NATURE OF COMETS
K. S. Krishna Swamy *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 14 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28846# Raman Research Inst., Bangalore (India).
NON-LTE PROCESS IN THE INTERSTELLAR MEDIUM
K. R. Anantharamaiah *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 7 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28848# Indian Inst. of Astrophysics, Bangalore.
ABUNDANCE GRADIENT IN INTERSTELLAR MEDIUM
Sunetra Giridhar *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 13 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N86-28900*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC PROPERTIES OF JUPITER'S TAIL AT DISTANCES FROM 80-7500 JOVIAN RADII
M. L. Goldstein, R. P. Lepping, and E. C. Sittler, Jr. Sep. 1984 64 p
(NASA-TM-86159; NAS 1.15:86159) Avail: NTIS HC A04/MF A01 CSCL 03B

A detailed study of the magnetic field data from both Voyagers 1 and 2 has revealed several interesting properties of the near and distant Jovian magnetotail. During the first encounter, as Voyager 1 passed between 80 and 140 R sub J from Jupiter in the near tail, the spacecraft was almost entirely in the northern lobe magnetic field. The frequency spectrum of magnetic fluctuation in this region cannot be characterized by a power law and does not appear to be turbulent. The distant tail spectra from Voyager 2 are compared with similar spectra obtained from Voyager 1 when it was in near radial alignment with Voyager 2. Although the gross properties of the tail and solar wind fields in most respects differ considerably, the shape and power levels of the spectra of the magnetic fluctuations are very similar, especially between .0001 and .001 Hz. At lower frequencies (.00001 to .0001 Hz) the spectra of magnetic helicity do differ. Author

N86-28901# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
A THREE-DIMENSIONAL SELF CONSISTENT MODEL OF THE PLASMA INTERACTION BETWEEN IO AND THE MAGNETOSPHERE OF JUPITER [EIN DREIDIMENSIONALES SELBSTKONSISTENTES MODELL DER PLASMAWECHSELWIRKUNG ZWISCHEN IO UND DER JUPITERMAGNETOSPHAERE]
D. Wolf-Gladrow, A. Ebel, ed., F. M. Neubauer, ed., E. Raschke, ed., and P. Speth, ed. 1985 103 p In GERMAN
(Mitt-45; ISSN-0069-5882; ESA-86-96919) Avail: NTIS HC A06/MF A01

A model of the interaction between Io and the Jupiter magnetosphere was developed, complementary to the model of Luzemann. The three dimensional model allows the self consistent calculation of the electric field, current distribution, and magnetic field in the neighborhood of Io, as well as in the Alfven wave tubes if the conductivities in the ionosphere are given. The electric and magnetic fields are important for the calculation of particle orbits. The current of 2.8 million A deduced from Voyager measurement in the southern Alfven wave tube can be explained by the model. The magnetic field perturbations can reach values above 200 nT. Investigations which can be performed without major changes of the programs are proposed. ESA

N86-28292*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE VENUS BALLOON PROJECT
C. T. Stelzried, R. A. Preston, C. E. Hildebrand, J. H. Wilcher, and J. Ellis *In its* The Telecommunications and Data Acquisition Report 15 May 1986 8 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 03B

N86-28825*# Physical Research Lab., Ahmedabad (India).
WEATHERING EFFECTS AND SOLAR COMPONENTS IN TWO ALLEN HILLS CHONDRITES
J. T. Padia and M. N. Rao *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 74-75 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28844# Indian Inst. of Astrophysics, Bangalore.
MINOR PLANETS AND PLANETARY RINGS
J. C. Bhattacharyya *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 10 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

N86-28850# Arizona Univ., Tucson. Lunar and Planetary Lab.
INTERIOR OF SATURN
Jonathan I. Lunine *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 11 p Sponsored by Arizona Univ., Tuscon (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28851# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
THE COMPOSITION OF SATURN'S ATMOSPHERE
R. Courtin *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 13-20 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28852# Observatoire de Paris-Meudon (France).
THERMAL STRUCTURE OF SATURN'S ATMOSPHERE
B. Bezard *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 21-31 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28854*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
THEORIES FOR THE GENERAL CIRCULATION OF SATURN'S ATMOSPHERE
Michael Allison *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 43-52 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28855# Arizona Univ., Tucson. Lunar and Planetary Lab.
CLOUDS AND AEROSOLS ON SATURN
M. G. Tomasko and L. R. Doose *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 53-61 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28856*# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
UPPER ATMOSPHERE AND IONOSPHERE OF SATURN
S. K. Atreya (Michigan Univ., Ann Arbor.) *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 63-68 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28858# Observatoire de Paris-Meudon (France). Lab. d'Astronomie Infrarouge.
THE COMPOSITION OF THE TITAN ATMOSPHERE
Daniel Gautier *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 75-81 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28859# Arizona Univ., Tucson. Lunar and Planetary Lab.
TITAN'S SURFACE: NATURE AND IMPLICATIONS FOR CASSINI
Jonathan I. Lunine *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 83-88 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL STRUCTURE AND METEOROLOGY OF TITAN
Barney J. Conrath *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 89-94 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28861*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
ZONAL WIND IN THE STRATOSPHERE OF TITAN
C. B. Leovy (Washington Univ., Seattle.) *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 95-98 Sponsored by NASA (For primary document see N86-28849 19-88)
(Grant NSG-7085)
Avail: NTIS HC A14/MF A01

N86-28862*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOUDS AND AEROSOLS OF TITAN'S ATMOSPHERE
Robert E. Samuelson *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 99-107 Sponsored by NASA (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28863*# Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies.
PHASE EQUILIBRIA IN N2-HYDROCARBON SYSTEMS: APPLICATIONS TO TITAN
W. Reid Thompson *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 109-119 Sponsored by NASA (For primary document see N86-28849 19-88)
(Grants NGR-33-010-220; NGR-33-010-082)
Avail: NTIS HC A14/MF A01

N86-28864# Graz Univ. (Austria). Space Research Inst.
THE UPPER ATMOSPHERE OF TITAN
S. J. Bauer *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 125-128 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28865# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
TITAN'S HYDROGEN TORUS
W.-H. Ip *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 129-141 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

N86-28866*# Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
PHOTOCHEMISTRY OF TITAN
Darrell F. Strobel *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 145-148 Sponsored by NASA (For primary document see N86-28849 19-88)
(Grant NAGW-646)
Avail: NTIS HC A14/MF A01

N86-28883# Arizona Univ., Tucson. Lunar and Planetary Lab.
AERONOMICAL MEASUREMENTS BY CASSINI
Donald M. Hunten *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 287-288 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-28902# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
LATITUDINAL GRADIENTS OF THE SOLAR WIND PARAMETERS DURING 1976 AND 1977: HELIOS 1, 2 AND IMP IN-SITU OBSERVATIONS
R. Bruno, V. Villante, B. Bavassano, and R. Schwenn (Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).) Apr. 1985 26 p
(IFSI-85-5; ESA-86-97089) Avail: NTIS HC A03/MF A01

Interplanetary observations from Helios 1, Helios 2 and IMP spacecraft during the early portion of solar cycle 21 were used to investigate the latitudinal gradients of solar wind parameters with respect to the angular displacement from the current sheet inferred from synoptic white-light maps of the solar corona at 1.75 solar radii. Large latitudinal gradients for solar wind flow speed, proton density, and temperature are found. All these gradients become smoother towards the solar cycle maximum. Neither latitudinal nor temporal variations for magnetic flow and thermal energy density are identified. ESA

N86-28903# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
COMPOSITION AND PROPERTIES OF IONS STREAMING IN THE PLASMA MANTLE AND IN THE LOBE
S. Orsini, M. Candidi, and H. Balsiger (Bern Univ., Switzerland) Jan. 1986 28 p
(IFSI-86-1; ESA-86-97100) Avail: NTIS HC A03/MF A01

The ISEE-1 Ion Composition Experiment detects ionospheric and solar wind ions streaming tailward with the same parallel velocity in the open magnetic field lines regions of the geomagnetotail, at distances from 10 Re to 20 Re. This is an effect of the so called magnetospheric mass spectrometer which organizes these streams, allowing those ion having a certain flow velocity to get at a certain point down the tail. This effect mixes solar wind and ionospheric particles, thus filling the plasma mantle and the lobe region with a multicomponent plasma, cold, collimated, flowing with several energies, one for every ion species involved in this process. ESA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N86-28904*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NINETEENTH INTERNATIONAL COSMIC RAY CONFERENCE PAPERS. GENERAL INDEX, VOLUME 10
Frank C. Jones, comp. Jul. 1986 104 p Conference held in La Jolla, Calif., 11-23 Aug. 1985
(NASA-CP-2376-Vol-10; NAS 1.55:2376-Vol-10) Avail: NTIS HC as boxed set only $200/MF A01 per volume or E99 per entire set CSCL 03B

These volumes contain papers submitted for presentation at the 19th International Cosmic Ray Conference held on the campus of the University of California, San Diego, in La Jolla, CA, Aug. 11-23, 1985. The present volume contains a complete author index for volumes 1 through 9 and a list of the names and addresses of all those who attended the conference. Author

N86-28905*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A MULTIDISCIPLINARY STUDY OF PLANETARY, SOLAR AND ASTROPHYSICAL RADIO EMISSIONS Final Technical Report
Donald A. Gurnett, W. Calvert, R. Fielder, C. Goertz, C. Grabbe, W. Kurth, R. Mutel, J. Sheerin, M. Mellott, and S. Spangler Jul. 1986 39 p
(Grant NAGw-386)
(NASA-CR-177166; NAS 1.26:177166) Avail: NTIS HC A03/MF A01 CSCL 03B

Combination of the related fields of planetary, solar, and astrophysical radio emissions was attempted in order to more fully understand the radio emission processes. Topics addressed

include: remote sensing of astrophysical plasma turbulence; Alfven waves; astrophysical shock waves; surface waves; very long base interferometry results; very large array observations; solar magnetic flux; and magnetohydrodynamic waves as a tool for solar corona diagnostics. B.G.

N86-28283*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI OBSERVATIONS OF 416 EXTRAGALACTIC RADIO SOURCES
D. D. Morabito, A. E. Niell, R. A. Preston, R. P. Linfield, A. E. Wehrle, and J. Faulkner *In its* The Telecommunications and Data Acquisition Report 15 May 1986 16 p (For primary document see N86-28275 19-32)
Avail: NTIS HC A10/MF A01 CSCL 03B

N86-28819*# Cologne Univ. (West Germany). Abteilung Nuklearchemie.
COSMIC RAY RECORDS IN ANTARCTIC METEORITES
S. Vogt, U. Herpers, R. Sarafin, P. Signer (Eidgenoessische Technische Hochschule, Zurich, Switzerland), R. Wieler, M. Suter, and W. Woelfli *In* Lunar and Planetary Inst. International Workshop on Antarctic Meteorites 1986 p 55-57 (For primary document see N86-28811 19-88)
Avail: NTIS HC A06/MF A01 CSCL 03B

N86-28847# Tata Inst. of Fundamental Research, Bombay (India).
IMPLICATIONS OF X-RAY AND UV RADIATION ON INTERSTELLAR MEDIUM
K. P. Singh *In* Osmania Univ. Proceedings of the Platinum Jubilee Symposium of Nizamiah Observatory on Binary and Multiple Systems 1984 15 p (For primary document see N86-28834 19-88)
Avail: NTIS HC A08/MF A01

99 GENERAL

N86-28884# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Astrofisica Spaziale.
THE DISCOVERY OF THE SATURN SYSTEM: CASSINI'S LIFE AND ACTIVITY
Marcello Fulchignoni *In* ESA The Atmospheres of Saturn and Titan Dec. 1985 p 289-294 Presented at Workshop on Solid Bodies of the Outer Solar System, Vulcano, Italy, 9-13 Sep. 1985 (For primary document see N86-28849 19-88)
Avail: NTIS HC A14/MF A01